Chemical Age

INDEX TO ADVERTISERS

The first figures refer to advertisements in **Chemical Age** Directory & Who's Who, *the second to the current issue*

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CHEMICAL AGE

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SCIENCE IN INDUSTRY

WHAT is a scientist? To the enthusiastic academic, or even to the layman who has a reliable dictionary at hand, this may seem a fairly easy question to answer. But there is no doubt that some confusion about the nature and functions of the scientist has arisen in recent times, so that the word is sometimes taken to mean a 'pure' scientist and sometimes a technologist—i.e., one who applies his understanding of basic principles to the practical problems of industry.

Some welcome clarification of the scientist's functions was given by Sir George Thomson, F.R.S. (Master of Corpus Christi College, Cambridge) in his presidential address to the annual meeting of the British Association for the Advancement of Science, which is now taking place at Cardiff (31 August-7 September). Sir George showed, by a number of examples, how science and technology are interdependent, and how abstract concepts based on 'pure' science are important to material progress. "What we want as scientists," said Sir George, "is that the world should realise that we are not interested merely in making possible new drugs, television sets, or weapons, though all these are important, but in enlarging the bounds of human knowledge."

But it is to another paper, presented on the following day, that we must turn, since it deals more particularly with scientific progress as it has affected the chemical industry. This paper was presented by Dr. James Taylor, M.B.E. (director, Imperial Chemical Industries Ltd.) who pointed out that the chemist has played a great part in providing and improving sources of energy, but that his peculiar contribution is to the 'good life': "We travel along the M.1 at 100 miles per hour, or more, in fibre-glass-polyester motor cars propelled by high-octane fuels, listening to radio sets transistorised with high-purity germanium and silicon, reclining on p.v.c. upholstered seats, firmly but gently supported on polyurethane foams and, if we are lucky, accompanied by our ladies, clad in acrylonitrile and polyethylene-terphthalate and decorated by some of the more sophisticated products of the dyestuffs organic chemists. We eat our sandwiches from polyethylene packs with polymethylmethacrylate dentures."

In the modern chemical industry, it is essential to employ not only specialists, but also scientists with a widely based training in fundamental scientific principles and methods, who can appreciate what is technologically possible and desirable in plant design. Products, such as those from the Fischer Tropsch and the 'Oxo" processes, and indeed, all petrochemical products, require the application of techniques and instrumentation far removed from simple chemistry. This is also true of the other recent developments, for example, high density polyethylene and isotactic polyolefines, and still more so of the 'newer' metals like titanium and beryllium and of ultra pure metals or elements produced by zone refining.

Hitherto basic discoveries have but rarely arisen from deliberate work towards industrial purposes and if we are to promote them in the future, we shall have to ensure that there are sufficient individuals and institutes with "the freedom to gather fresh knowledge as and where inspiration comes." Universities are the places where traditionally this freedom is

jealously guarded and where the search for 'truth' or knowledge for its own sake is the primary object, and it is to them that we must look in a large measure for the fundamental discoveries of the future.

Dr. Taylor felt it likely that in the future we shall have to rely to an increasing extent on the professional who has behind him the resources of a university, a research institution or industry, to provide the continuity of discovery and progress of scientific ideas which is so essential to the nation's prosperity. We have a responsibility to provide suitable conditions in which scientific imagination and invention can prosper. Certainly a considerable number of promising research chemists must be given freedom to pursue their studies without ties or preselected targets, and their work must be judged by its scientific quality and not by its practical value.

GAS CHROMATOGRAPHY

TECHNIQUES of gas and gas liquid chromatography are being used increasingly not only as instruments of research but also in industrial process control and in the manufacture of extra pure chemicals. This increasing interest is borne out by the number of meetings and courses being devoted to the subject. The symposium held in Edinburgh earlier this year was over-subscribed and numbers had to be limited. In the U.S., too, a symposium held at Fisk University last year proved so popular that it is being repeated, as is the course to be held at the University of California in response to continuing requests from industry.

Producers of gas chromatography chemicals in this country report a growing demand from industry as do the manufacturers of gas chromatography apparatus. Griffin and George, manufacturers of the world's first commercial apparatus, sell units to some hundreds of firms in this country and overseas, including China, Russia and many European countries. I.C.I. alone have purchased in the region of 40 instruments.

Gas chromatography is being used extensively for the monitoring of processes in many fields including plastics, paints, essential oils and solvents. It is gradually, with the development of more sensitive detectors, better reagents and more efficient columns to help decrease analysis time, being moved from the quality control laboratory into the plant itself. I.C.I.'s Billingham Division engineering development section manager, J. Mawson, reports in a letter to the U.S. journal *Industrial and Engineering Chemistry* (1960, **52**, No. 2, 65A), that the Billingham and Wilton plants now use a fairly large number of automatic plant stream analysers mostly of their own design and construction. The development of radioactive isotope-excited ionisation gauges along with gas discharge tube detectors have made it possible to use gas liquid chromatography for the measurement of parts per million in complex mixtures.

The majority of automatic analyses are required to provide information about trace components at various parts of the plant stream; this is particularly important when the products are destined for polymerisation plants which demand a very high purity. Gas liquid analyses are, by nature of the method, discontinuous, and if information yielded is to be useful in automatic control applications rapid analyses must be made. Such analyses of complex hydrocarbons are being realised at I.C.I.'s Wilton works by using more efficient columns, column switching techniques and flow acceleration during periods between peak emergence from the column.

The removal of the gas chromatography technique from the laboratory is part of Armour Industrial Chemical's new quality control programme. The U.S. journal, *Chemical and Engineering News*, 18 July, reports that this step on the road to in-stream anaylsis is based on a new method for the conversion of fatty acids to their methyl esters, cutting sampling and analysis time from hours to minutes. Fatty acids as such do not chromatograph well, and previously a lengthy esterification process was necessary, but increased rapidity of analysis is now made possible by the use of a new reagent, boron trifluoride, which achieves complete esterification in two minutes. With faster analysis times, stream samples can now be run hourly in the plant.

The increasing use of gas chromatography in industry is matched by its continuing popularity as a research tool. By this means minute traces of chemicals are being discovered in what were thought to be pure substances. For example, some of the purest grades of chloroform turn out to contain four to five impurities. The correlation of property to quantity and type of impurity is being investigated in many instances. The U.S. National Bureau of Standards reports the use of gas chromatography for the easy characterisation of acrylic polymers and copolymers, and the National Heart Institute in America say, in a letter to *Nature*, 9 July, that mixtures of steroids and alkaloids can now be separated more quickly and more completely than ever before by gas chromatography.

SULPHURIC ACID TREND

IN his recent survey of the British chemical industry (CHEMICAL AGE, 20 August, p. 279), Mr. S. P. Chambers, chairman of I.C.I., referred to the special economic significance with which sulphuric acid has been endowed since Leibig suggested in 1843 that its annual production could be used as an indicator of the commercial prosperity of a country.

No one chemical is made in greater quantities for at present nearly 2.5 million tons a year are made in the U.K. Mr. Chambers cast doubts on whether sulphuric acid was in fact an accurate indicator, because its usage is not proportionately spread over all activities which contribute to the national product—agricultural activities are heavily weighted accounting for a third of the acid output. Despite this, major changes in Britain's economic position are reflected by consumption of sulphuric acid, which as Mr. Chambers said, has for the last 25 years been rising at an average rate of 4.3% per annum and shows no sign of slackening. In the first quarter of 1960, acid consumption, at 700,200 tons showed a rise of 13.9% over the same period of 1959, while for the first half of 1960, consumption totalled 1,373,800 tons, a rise of 12.7% over January to June 1959.

The U.K. consumption figures produced by the National Sulphuric Acid Association show that while actual tonnages used in the production of superphosphates and ammonium sulphate have been rising, these two fertilisers are accounting for a declining proportion of the total acid consumption. The July edition of *Sulphur* shows that while fertilisers accounted for 244,300 tons of acid in the first quarter of this year, compared with 235,500 tons in the same period last year, the 1960 figure represented 34.9% of total acid consumption, compared with 38.8% in 1959.

In the first quarter of this year, acid used in the production of titanium dioxide was up 34% over the same period of last year, usage figures in other cases increased as follows: dyestuffs and intermediates, by 25.9%; rayon and cellulose film, by 14.2%; and metallurgical industries, up by 26.1%.

Next to the U.S., the proportion of sulphuric acid consumed by the U.K. fertiliser industry is the lowest in the world. In view of the upward trend in the industrial usage of sulphuric acid, it is expected that the importance of sulphuric acid in fertilisers will decline still further.

Johnson, Matthey Produce Arsenic with 1 p.p.m. Impurity Level

HIGH-PURITY arsenic, antimony, tellurium and bismuth are now being produced on a commercial scale by Johnson, Matthey and Co. Ltd. By means of newly developed techniques, arsenic is being produced with an impurity level of the order of 1 p.p.m., detected by use of present known and accepted spectrographic methods. The element is in the form of crystalline lumps and is packed in vacuum-sealed glass tubes.

Antimony, with a maximum metallic impurity content of 5 p.p.m., and bismuth, with a maximum level of metallic impurities of 10 p.p.m., are being produced in ingot form. Zone-refined tellurium, with a metallic impurity content of the order of 1 p.p.m., is also available in bulk as ingot or grain.

Of increasing importance to the semiconductor industry, these four high purity metals find growing application in the form of inter-metallic compounds. For example, gallium arsenide is used in the production of special diodes and transistors, indium antimonide and indium arsenide are used for magneto-sensitive devices and bismuth telluride is used in Peltier cooling units.

3 M. Hours, No Lost-time Accidents, at I.C.I. Factory

The Castner-Kellner factory of I.C.I.'s General Chemicals Division has completed 3 million hours without a 'lost-time' accident. Earlier, on 8 August, they had broken the I.C.I. record of 2,871,970 held since 1935 by the Crosslee factory of Nobel Division.

Several other works within the Division have excellent safety records. The Division's research department have on three separate occasions worked 1 million hours without a lost-time accident, as have Rocksavage works. The Division engineering department and Pilkington-Sullivan works have recorded two separate millions; Wigg works have recently completed their second consecutive million while six other works or departments have secured the one million.

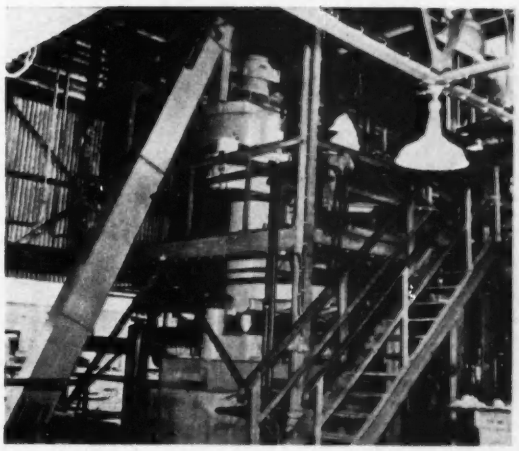
P.I.B. Figures Show Big Increase in Chemical Feedstock Deliveries

During the first half of this year, when U.K. oil consumption rose by 18.7% as compared with the same period of 1959, the biggest percentage increase in deliveries was that for chemical feedstock and products supplied to the gas industry, which went up by 62.9% to 1,057,132 tons. This is revealed in figures issued by the Petroleum Information Bureau in London.

Comparative figures for deliveries of other major petroleum products for the January-June period include: industrial spirits (including industrial benzole), 3,636,905 tons (3,351,390 tons in January-June 1959); white spirit, 80,321 tons (78,031); lubricating oils and greases, 488,544 tons (445,306); paraffin wax and scale, 25,561 tons (25,744); propane and butane, 72,495 tons (58,002).

Project News

Durgapur Naphthalene Plant Commissioned in India



View of the hot press machine in the naphthalene plant

THE naphthalene plant associated with the by-products plant at Durgapur steelworks, India, has now been commissioned. The naphthalene plant works in conjunction with the tar plant which produces the crude naphthalene oil. This is pumped from the storage tanks at the tar plant and delivered into crystallising trays at the naphthalene plant. The naphthalene oil is allowed to cool for four days to permit complete crystallisation, the oil then being drained off and pumped back to the tar plant for blending purposes.

The solid naphthalene crystals are then transferred to the 'hot press' unit for pressing into cakes of refined naphthalene. The cakes are delivered by conveyor belt to a crusher and bagging machine and then to storage for subsequent loading to road or rail transport.

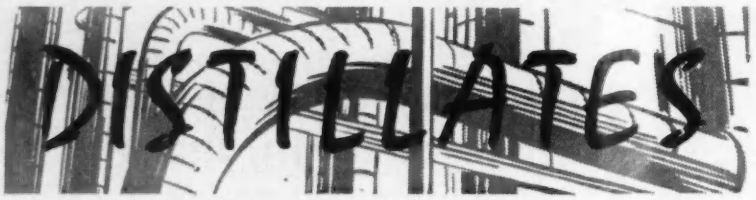
The plant at Durgapur is designed to handle 36 tons/day of crude naphthalene oil to produce approximately 20 tons of refined naphthalene. It has been built by Simon-Carves Ltd., a member company of ISCON —the British consortium constructing the steelworks at Durgapur.

● THE Lummus Co., U.S., has been awarded the contract for design, engineering and procurement of a major caprolactam monomer project at the Hopewell, Virginia, plant of the National Aniline Division of Allied Chemical Corporation. Completion of construction, mid-1961, will approximately double Allied's production of caprolactam monomer and make the Hopewell plant the largest caprolactam producer in the world. The expanded Hopewell plant will use Allied Chemical-produced phenol as raw material to manufacture the caprolactam monomer which, in turn, will be utilised in other Allied plants for the production of Nylon 6 tyre and textile yarns.

● TWO contracts, valued together at approximately £13,000, have been awarded William Boby & Co. Ltd. by the National Coal Board. Both contracts are for fully automatic type dealkalisation/base exchange plants, one for Sutton Manor Colliery and the other for Altham Coke Ovens.

● BUELL LTD., 3 St. James's Square, London S.W.1 (a subsidiary of Edgar Allen and Co., Sheffield), have received an order for the erection of three Buell vertical turbo dryers, each with an output of 9½ tons per hour of china clay. The three dryers will be installed at three different sites in the Cornish area, and the erection of the first is due to begin in November of this year and be in operation by March 1961. The total value of the order is approximately £100,000.

● THE Gas Atmospheres Division of the Incandescent Heat Co. Ltd., Smethwick, has received a contract worth some £55,000 for three gas generators, each producing 10,000 s.c.f.h. of a nitrogen/hydrogen mixture, to be installed in a large Belgian steelworks. Hydrogen can be varied between 1 and 12%; CO and CO_2 are very low. The plants will operate on coke oven gas, but the design is equally suitable for town gas, propane or butane. In these plants, the fuel gas is burned with a deficiency of air: after removal of CO_2 this gives a gas with e.g. 5% CO and 3½% H_2; balance nitrogen. The CO is then reacted with steam through a special catalyst bed at a carefully controlled temperature to perform a shift reaction: $CO + H_2O - CO_2 + H_2$ with a consequent increase in hydrogen (3% CO producing 3% H_2). The product is then passed through monoethanolamine solution to remove CO_2 down to approximately 0.02%.



★ LAST week's announcement from Washington that the U.S. authorities had adopted the new Sabin-type oral polio vaccine as a standard for manufacturing, is likely to be followed by other governments, thus opening the way to widespread use of oral vaccine in many countries of the world. In the U.K., Pfizer are already well advanced in the production of the Sabin vaccine and expect to hold a leading position in the race to produce it. Pfizer Ltd. commenced manufacture of the Sabin-type product at the beginning of the year and already have millions of doses undergoing the arduous testing procedures shortly to be regularised by the U.S. authorities. Scientists from the British company recently joined representatives of U.S. industry and Government in Washington at a conference which was called by the U.S. Public Health Service to discuss recommendations for the production and testing of the vaccine.

Pfizer Ltd. will supply its associate company in the U.S. with the new vaccine, thus enabling them to make it available there at an early date. All vaccine produced is expected to meet British test regulations also.

In making their announcement, Pfizer acknowledge their indebtedness to Dr. Albert E. Sabin, developer of the vaccine, "who has provided excellent scientific guidance."

★ BRITAIN'S first liquid helium plant to be run by an industrial organisation started service recently at the Morden, Surrey, works of British Oxygen Research and Development Ltd. I learn that a standard liquefier is being used and that the plant will produce sufficient liquid helium to meet all present demands from industry and research bodies in this country.

The National Physical Laboratory, Teddington, which has run a plant for a number of years, is now gradually discontinuing production and handing over its customers to B.O.R.A.D. The only other sources of liquid helium in the United Kingdom are certain university laboratories, where low temperature research is carried out.

★ I AGREE with Dr. Taylor of I.C.I., whose comments at the British Association meeting are recorded in page 345, that the chemist's main contribution to social progress is in providing the requisites of the 'good life'. One of these is surely swimming pools, especially of the smaller variety, for the advent of plastics has led to the introduction of relatively cheap, ready-made pools which are easy to install in back gardens of quite moderate proportions. In the U.S. it is obvious that film stars and millionaires no longer have a monopoly of home swimming pools, for some 80,000 new pools are expected to be installed this year (though not, presumably, all plastic ones), which will bring the U.S. total to more than 300,000.

Of course, having installed your pool, you still have the problem of keeping the water free from harmful contaminants, e.g. by the addition of chlorine. So here again the chemists step in. It was chiefly the increased demand for dry chlorine in the U.S., for instance, that led Olin Mathieson to double production of their 'HTH' product at Niagara Falls, as reported in last week's CHEMICAL AGE (p. 326).

In the U.K., too, the idea of a swimming pool for every home is just beginning to catch on, which means good business for the plastics manufacturers and for suppliers of chlorine as well.

★ IMPROVED types of polyester spray-on coatings, which contain a catalyst to harden and cure, are meeting demands from a wide variety of fields from chemical plant components to the protection of engineering drawings. The coatings are tough and pliable and are resistant to water, dirt and chemicals—in one test surviving boiling caustic soda for six weeks without deterioration. They are made in clear colours blended to match the ultimate use of the sprayed article and look like a conventional paint finish.

Each job must be evaluated so that the right mixture of ingredients may be prepared (no more than a pint at a time due to the rapid hardening) and the cost of coating varies between that of stove and vitreous enamelling.

★ SMALL boys ever, few of us can resist the fascination of pressing the buttons that make the models work in the Science Museum at Kensington. So it was a particular delight to be able, in a purely professional capacity, to press the buttons that light up the brand new model presented to the Museum by the Albright and Wilson Group. In the brief informal ceremony held at the Museum last week, the model was handed over to the director of the Museum on behalf of Albright and Wilson by Sir Owen Wansbrough-Jones, the Group's technical director.

The model is contained in a four-sided show case, but shows that phosphorus and its products is a subject that has many more sides. In one panel, there is a model of a phosphorus plant, with the electric furnace, precipitation and condensers cut away to show the interior. A press of the button illuminates the model and shows the flow of the materials. Another side of the show case is devoted to the properties of condensed phosphates, illustrated by molecular models, while a third side shows the uses of phosphorus chemicals. Here there is an illuminated diagram showing the various products stemming from phosphorus and their multitudinous applications, and, below it, some intriguing hexagonal compartments each containing a model illustrating some practical application of phosphorus products, such as insecticides, flameproofing, water treatment, detergents, etc.

Finally, on the fourth side, some further models give a potted history of phosphorus as a chemical element, starting with its preparation from urine by Brand, a German alchemist, in 1669.

★ THE big I.C.I. works are usually pretty well 'on the ball' when it comes to training their operatives, the latest example being the use of models as an aid to explaining the mysteries of plant and equipment to the employees of the Wilton olefine works.

The models, which are being used in an induction course just starting, illustrate typical pieces of plant and equipment. They have been made by I.C.I. apprentices who two months ago produced an experimental model for the olefine works. It was clear that this type of sectioned model would help the course a great deal and so it was decided to have a further eight made. Using plant drawings, the apprentices have now made scale models of three heat exchangers and one re-boiler.

The models have been so designed as to show the location of pipes, controls, etc., and Perspex has been widely used in their construction with other parts being made from brass, mild steel and other materials.

★ A DISCOVERY which may revolutionise the struggle against the fungus diseases which attack crops was announced recently at the International Symposium on the Chemistry of Natural Products. Dr. D. R. Perrin and Dr. W. Bottomley, of the C.S.I.R.O. Division of Plant Industry, told a meeting of the symposium of the discovery of Pisatin, a substance produced by plants in response to fungal infection. Now that the chemistry of the first natural disease-resistance substance of this kind in plants is known, a new field of research is opened. It may be possible to produce chemicals similar to Pisatin which can be used to spray plants to protect them from plant diseases. C.S.I.R.O. scientists are very interested in the possibility of producing fungicides which, like antibiotics in humans, might spread throughout the whole of plants and give complete immunity to disease.

Alembic

New Process Yields Ammonium Sulphate from Smelter Gases

A PROCESS for manufacturing ammonium sulphate from sulphur dioxide-containing gases, by-passing the use of sulphuric acid, is being made available on licence by the Spanish pyrites company, Piritas Españolas of Madrid. The process has so far been operated on the pilot scale but Piritas are now designing a plant with a capacity of 50,000 tons a year. Low capital and operating costs are claimed for this process, feed for which can be smelter flue gas (2-4% SO_2) or gas obtained from pyrites roasting (7-15% SO_2).

According to a description in *Chem. & Engng. News*, 1960, **38**, No. 35, 44, the process starts with the cleaning and cooling of feed gas, which is then passed through a packed absorption column containing the basic organic solvent. The exact composition of the solvent is not revealed, but possible materials include xylidine, pyridic bases from coal tar, methylaniline, quinoline or the like, either separately or in combination. The incoming SO_2 combines with this solvent to make a basic sulphite and the liquid stream then goes on to the reactors, through which air is blown to oxidise the sulphite to sulphate.

Next, the stream passes into a saturator where the organic base sulphate is decomposed with ammonia. The reaction frees the organic base, which rises to the top of the reactor, is decanted off, separated from the entrained solids by settling, and is then recycled to the absorption tower for re-use.

The crystals of ammonium sulphate from the saturator, supplemented by those from the settling step, are centrifuged and dried. Suitable heat exchange circuits and recycle streams increase yields and decrease energy needs.

British Automatic Tank Gauging Equipment for Norwegian Refinery

AUTOMATIC tank gauging equipment for installation at the new Slagen, Norway, refinery has now been delivered to Esso-Raffineriet, Norge, by Firth Cleveland Instruments Ltd. The order was placed through Bechtel International Ltd., and includes equipment for the detection of liquid level in all the major storage tanks of the refinery, with facilities for data display at a central control console.

All the Firth Cleveland equipment was manufactured at Treforest, Glamorgan, under licence from Gilbert and Barker Manufacturing Co., of West Springfield, Mass, U.S., but a considerable amount of special design work was contributed by Firth Cleveland, including the whole of the remote receiver instrumentation and console design. In addition a matching console was provided for blending and batching purposes, including provision for the indicators of Brodie remote-indication positive displacement flowmeters, complete with ticket-printing facilities.

The complete installation permits almost the whole of the liquid transfer operations of the refinery to be carried out from the central control room with a high degree of precision.

New Surface Treatment for Aluminium Improves Adhesion of Coatings

A NEW chemical surface treatment for aluminium, Chemlok 270, is claimed to greatly improve the adhesion of paints, lacquers, enamels, adhesives and other coatings to the metal. According to the sole British selling agents, Durham Raw Materials Limited, 1-4 Great Tower Street, London E.C.3. Chemlok 720's high level of adhesion results from a chemical reaction forming polar organo-aluminium compounds of molecular thickness at the aluminium surface. This produces an organic surface which exhibits greater compatibility and adhesive strength with the organic coatings subsequently applied.

Adhesion obtained with Chemlok 720 is stronger than the coating applied—the paint film will fail cohesively rather than strip off the aluminium. This means that new highly-resistant paints and coatings adhere until completely weathered away, while coated aluminium parts can tolerate greater deformation during manufacture without injuring the coating.

£560,600 for Pesticides Research in Colonial Development Scheme

A grant of £560,600 for research work on pesticides was approved during the last financial year, as part of the U.K. contribution to colonial development, according to the annual return of schemes made under the Colonial Development and Welfare Act by the Secretary of State for the Colonies. For the first time, the return gives details of Exchequer loans approved towards Colonial development programmes. In the year under review—1 April, 1959, to 31 March, 1960—a total of £17,987,500 was made available under this heading.

J. D. Campbell Offer New Potato Haulm Killer

A NEW potato haulm killer, Dee Foliet NU, has been developed by J. D. Campbell and Sons Ltd., Manchester, and is claimed to meet the need for an economical, effective and non-poisonous chemical to fill the gap when use of arsenite is discontinued. Dee Foliet NU has been extensively field tested in different parts of the U.K. and, Campbell's say, has proved highly effective as a potato haulm destroyer. Patent application has been filed for this product.

Glaxo Influenza Vaccine, Invirin, Goes to Industry

An influenza vaccine manufactured by Glaxo Laboratories, which includes a strain of influenza isolated in this country last year, is being made available to industrial medical officers for the coming winter. The vaccine, Invirin, contains two strains of virus considered to be most likely to be involved if an epidemic occurs.

Course on Isotopes for Trade Union Officials

A four-day course for trade union officials on the industrial uses of radioisotopes is to be held at the United Kingdom Atomic Energy Authority's Isotope School, Wantage, Berks, 20-23 September. The T.U.C. have so far nominated 37 trade union officials for the course, which will include a programme of lectures, discussions and visits.

U.S. Work on Extender Pigments Published in U.K.

The results of four years' work by the Research Division of National Starch and Chemical Corporation (one of the two largest PVA producers in the U.S.A.) have just been published in the U.K. as a report entitled 'The Function of Extender Pigments in Exterior Vinyl Emulsion Paints'. Extenders covered in the tests included a range of talcs, clays, carbonates, silica, mica, etc.

Copies of the report are available from the Resin Division, National Adhesives Ltd., Slough, Bucks.

Treasury Brings in New Hydrocarbon Oil Duties Order

The Treasury have made the Hydrocarbon Oil Duties (Drawback) (No. 2) Order, 1960, which varies the rates used for determining the quantities of hydrocarbon oil in respect of which drawback is allowed as respects industrial adhesive tapes and certain dyestuffs intermediates. It also withdraws the provision for drawback in respect of 3-hydroxy-2-naphthom-nitroanilide.

The Order came into operation on 30 August and has been published as Statutory Instruments 1960, No. 1531.

Technical Progress May Reduce Atomic Power Costs–I.A.E.A. Report

PROSPECTS of improvements in the technology of nuclear power generation resulting in a reduction in costs are indicated in a report on nuclear power economics prepared by the International Atomic Energy Agency. The report is being submitted by the Agency's board of governors to the I.A.E.A. General Conference which meets for its fourth regular session in Vienna on 20 September.

It is stated that possible reductions in fuel cycle costs, resulting from lower fabrication and re-processing charges, higher burn-ups and a fall in uranium prices, will be especially significant. Development of improved but low cost reactor materials will also result in an overall economy. Again, sizeable savings can be expected from the standardisation of reactor components. Further, with a better understanding of the essential safety requirements, containment and control of reactors will become simplified and less expensive. Finally, when several nuclear power plants of essentially the same design are built, the engineering development expenses will be spread out and the cost per unit will decrease.

According to a recent U.S.A.E.C. evaluation, which assumes a 14% annual capital charge, an 80% plant factor, no changes in the Commission's present schedule of uranium prices and in the purchase price of plutonium, the generating cost of power produced from a 200 Mw. (electrical) reactor fuelled by slightly enriched uranium, which on the basis of present technology would fall between 11 and 14 mills per kwh., is expected to decrease later to 9 to 10 mills/kwh. Under these conditions and assuming that efficiency improvements of conventional thermal power plants are levelling off, the cost of power generated in a large nuclear power plant to be installed towards the end of the next decade would become competitive with that of conventional thermal power in areas where conventional fuel costs are 55 cents per million B.Th.U. (U.S. $2.20 per million kilocalories).

The I.A.E.A. report is primarily concerned with moderate and large sized power reactors, especially of those types the technology of which have been or are about to be operated on an industrial scale.

Recommendations for Sea Transport of Dangerous Goods and Explosives

AMENDMENT List No. 4 to the 1957 Report of the Standing Advisory Committee on the Carriage of Dangerous Goods and Explosives in Ships (H.M.S.O., price 11s 6d), revises and brings up to date the Committee's recommendations for carrying dangerous goods and explosives by sea. New packings have been included for many of the substances listed in the Report, and other changes in the entries have been made; some substances are now dealt with for the first time.

The amendments to the Explosives Section will be included in a new edition of the document 'Rules for the Packing, Stowage and Labelling of Explosives for Carriage by Sea', which is being reprinted in loose leaf form.

Benn Brothers' Journals Will Maintain Their Integrity, Says Mr. Glanvill Benn

THE 64th annual general meeting of Benn Brothers Ltd., publishers of CHEMICAL AGE and other technical and trade journals and directories, was held on 26 August at Bouverie House, Fleet Street, London E.C.4.

In his statement the chairman, Mr. Glanvill Benn, said that in this 80th year of the company—despite the fact that the year began with a loss caused by the printing stoppage, the final result was a satisfactory profit, which, before taxation, amounted to £93,884 compared with £76,775 the preceding year.

After speaking of new projects during the year which ended on 30 June, Mr. Benn turned his attention to more general matters. "Politicians," he said, "pay lip service to the great British tradition of a free Press, but many have shown by word and deed that they would prefer controls on both editorial and advertising. The hands of these little Mussolinis have been strengthened, it may be thought, by recent changes in the newspaper and periodical publishing world. Too many journals are now in too few groups.

"The Benn Group is not yet of a size to be open to such criticism: which will not, however, deter us from further expansion if opportunities offer. To maintain the integrity of each individual journal, the accuracy and completeness of each directory, whatever their sum total, and so to confound the critics of the Press, will continue to be our constant endeavour."

Commenting on journals in the Group, Mr. Benn noted that CHEMICAL AGE continued to keep abreast of developments in the chemical industry and a readership survey carried out during the year, and independently audited, showed that each copy had an average of 6.38 readers. *The British Trade Journal and Export World*, with a readership covering 105 overseas countries, was readily used by Ministers of the Crown and leading industrialists as a platform for their views on promoting overseas trade.

Another publication dealing with British exports was mentioned by Mr. Benn. Known as *Benn's Far-East Directory*, the first edition was published in June. The only book of its kind, it is designed for importers of British goods in Far-Eastern markets. A Chinese section gives a translation of the Buyers' Guide headings in Cantonese Chinese alphabetical order—believed to be the first time this has been attempted.

Obituaries

Mr. Charles Frederick Dutton, a past-president of the Association of Tar Distillers in 1957/8, and vice-president of the British Sulphate of Ammonia Federation has died at the age of 67. He joined the commercial department of Powell Duffryn in 1909 and after service in the 1914-18 war he returned to Powell Duffryn and eventually became by-products sales manager. He joined the National Coal Board as Assistant Director of Marketing (By-Products) when the coal industry was nationalised. He retired from that position on 31 January this year. During his working life he took a prominent part in the affairs of the various by-product associations. He was a member of the executive and finance committees of the British Tar Confederation and of the British Road Tar Association.

Mr. J. A. White, director of Witco Chemical Co. Ltd., Manchester, died suddenly at his home on 27 August at the age of 53. A fluent linguist, he joined Witco 20 years ago and, well known in the European chemical field, he travelled the Continent extensively in connection with the company's manufacturing and sales development of carbon black.

STEADY PROGRESS WITH HIGH POLYMERS

Review of I.U.P.A.C.'s International Symposium on Macromolecular Chemistry

STEADY achievement in research on high polymers, rather than outstanding novelty, was the keynote of the annual meeting of polymer scientists, organised under the auspices of I.U.P.A.C., which took place this year at the Lomonosov State University, Moscow. Some 1,200 participants gathered to consider a programme of about 180 papers dealing with chemical problems in the synthesis and transformations of natural and synthetic macromolecules.

The large contribution of the Eastern bloc to the symposium provided visitors with an opportunity to assess the activity of these countries, and particularly that of the U.S.S.R., in current polymer chemical research. East German reports were few, possibly for linguistic reasons, whilst Czechoslovakian—and, to some extent, Hungarian—work was generally elegantly conceived and carefully executed, even if limited in scope. Too many of the Russian papers, however, tended to be imitative of work already well known and to reveal evidence of a somewhat restricted standard of technique as well as of a less than critical approach to the evaluation of processes and products. There were, of course, some notable exceptions to this, and it is clear that investigations of considerable ingenuity are proceeding on organic semiconductor polymers and in studies aimed at providing materials stable at very high temperatures.

Reports on these topics—which, as in so much analogous work in the West, are still exploratory rather than in a state of technical realisation—disclosed incidentally the widespread use in Russian laboratories of the electron spin resonance method for the study of free radical processes. Whilst this method is certainly in growing use in the rest of Europe and in the U.S., it does not yet seem to have 'caught on' in the degree now apparent in the U.S.S.R. Without doubt the relative retardation of certain aspects of Soviet work on polymers reflects adverse social and economic conditions of historical origin, but with the emphasis now placed by the State Plan on the chemical and synthetic polymer industries and their basic sciences, it is likely that this situation will change greatly in the years to come.

Whilst the detailed transaction of the symposium included many papers of merit on theoretical as well as practical polymer studies, readers of this journal will probably prefer the available space to be devoted mainly to less familiar work on the preparation and properties of polymers. The Russian contributions will therefore be emphasised and, for brevity, only the presenting author of each paper will be mentioned.

Condensation Polymers. Although high polymers have been prepared for some years by fast polycondensation reactions at the interfaces of immiscible liquid mixtures, the use of this method has recently acquired special prominence through the extended studies of du Pont chemists, and the detailed study of its peculiarities has been taken up by many workers, including those of the Eastern bloc. Several papers dealt with the detailed parameters of this process. Akutin and Mikhailov (U.S.S.R.) both reported on differences in yield and molecular weight in varied approaches to the formation of polyamide powders, films and fibres in this way, whilst

by

Dr. I. Goodman

Alexandru (Rumania) described the formation of a polyurea from phosgene and hexamethylene diamine solutions. Despite the versatility of the approach which permits the formation of many otherwise difficultly accessible polymers, there was still no clear indication of its industrial application other than to polymers of the polycarbonate resin type.

Several papers by French, Hungarian, Czech and Polish workers dealt with mechanistic problems in the polymerisation of caprolactam, and Volokhina (U.S.S.R.) discussed the energetics of amino-acid polycondensations in the solid state. Only one really novel class of polyamides was mentioned, however, this being the group of N-substituted 1-nylons described by Mark (U.S.A.) as film and fibre-yielding products, some of quite high melting point, obtained by ionic polymerisation of the C=N bond in isocyanates.

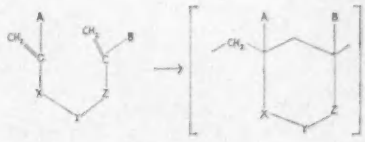
Relatively few reports dealt with polyesters, but Kefeli (U.S.S.R.) gave some account of his methacrylate-terminated poly(ethylene phthalate) telomers which can be cured to give infusible elastic or glassy products. Other Russian papers included that of Zilberman on the use of dinitriles in polyester synthesis via polymeric iminoethers, and of Yakubovitch on the stability of the polycarbonate of diphenylolpropane; this polymer appears to be rather prone to reactions of alcoholysis, and—at high temperatures—to interchange reactions which can be used to equilibrate blends of differing molecular weights.

Structural studies with oligomeric polypeptides and polyesters were described, respectively, by M. Goodman (U.S.A.) and I. Goodman (U.K.); the former paper yielded evidence on the degree of chain complexity required to form the characteristic molecular helices in proteins, whilst the latter included reference to the synthesis of a novel crystalline, fibre-forming ethylene/3-oxapentamethylene terephthalate equimolar copolymer.

Isotactic and Stereospecific Polymerisation. To the relief of at least some members of the Moscow conference, the flood of memoirs on the regulated polymerisation of the commoner olefines which has been so strong a feature of symposia in recent years now shows signs of abating. A group of papers covered further points of detail concerning catalyst compositions and theories of action, but no essentially novel principles emerged. However, in the taxing problem of the determination of local symmetry in only partially eutactic polymers, interesting proposals were made by Birshtein (U.S.S.R.) for the use of infra-red dichroic methods to diagnose local iso- and syndiotacticity, and by Tsvetkov (U.S.S.R.) for the determination of tactic form by its effect on flow birefringence.

Novel isotactic polymers were described by Overberger (U.S.A.) who has obtained a crystalline poly(vinyl cyclopentane) stable to 260°C, and a crystalline, high melting poly(vinyl cyclopropane) capable of being spun to fibres. K. Butler (U.K.) reported on insoluble polymers of high softening point made by the anionic polymerisation of N,N-disubstituted acrylamides. Unlike their soluble and lower softening atactic counterparts, these substances crystallise with great facility and one such polymer, poly(N,N-dibutylacrylamide), which softened around 350°C was prepared by lithium butyl catalysis in a homogeneous system.

Cyclopolymerisation. Papers by Marvel (U.S.A.), Arbuzova (U.S.S.R.), and Matsoyan (U.S.S.R.) demonstrated the extent of progress in studies on the interesting intraintermolecular polymerisation of non-conjugated dienes. The reaction may be written in general form:



where groups A, B can be H, COOR, CN, Ph; X and Z can be CH_2, $(CH_2)_n$, CO or ester groups, and Y can be organic or may include oxygen, nitrogen, phosphorus or tin atoms. In a case recorded by Nametkin (U.S.S.R.), the reaction was extended to methylphenyldiallylsilane giving a product which melted only at 400°C, whilst in yet another extension due to G. B. Butler (U.S.A.), divinyl ether and maleic anhydride were combined to give a high melting product containing alternating cyclopolymerised and succinic anhydride

units. Further interesting results can clearly be expected in this fascinating field of addition reactions.

Semiconductor Polymers. Russian activity in this relatively new field was exemplified by the papers of Semenov, Berlin and Geiderikh which described varied approaches to the problem of synthesis of polymers which initially contain extended conjugated unsaturation or which are capable of yielding electron-conducting paths on ionisation. The structural types under examination include: (1) pyrolysed polymers and copolymers based on vinyl chloride, acrylonitrile and m-divinylbenzene; (2) synthetic linear poly-p-phenylenes and homo- and copolymers from p-diethynylbenzene, (3) certain condensation products such as poly(p-phenylene phthalate) and polymers made from the reactions of quinones with aromatic diamines or aryl *bis*-diazonium compounds, (4) phthalocyanine polymers made from tetracyanodiaryls and copper or iron compounds, (5) novel analogues of the phthalocyanines obtained by the reaction of metal compounds with tetracyanoethylene or its mixtures with phthalonitrile. Certain of the quinone-amine condensates can themselves be complexed with metal compounds, yielding products having interesting magnetic and electrical properties.

Thermostability

Polyhydrocarbons and other potentially thermostable materials. A number of contributions presumably inspired by the theme of thermostability in high polymers described the synthesis of non-vinyl hydrocarbon types and also of some metal-containing substances. Vansheidt (U.S.S.R.) has concentrated on the synthesis of structures of the types $(-R-CH_2-R'-CH_2-)_n$ and $(-RCH_2CH_2-)_n$ where R,R' may be either similar or dissimilar arylene groups. Most of these products were crystalline, soluble only at elevated temperatures, and high melting (mainly in the range 250-430°C); their molecular weights, however, were rather low. Korshak (U.S.S.R.), on the other hand, has applied a radical-induced dehydrogenation reaction to the conversion of $PhCH_2R$ compounds to polymers of the form $[Ph(R)C<]$, having molecular weights ranging from 10,000 to 900,000. The polymers with R = Ph, COOMe and $COCH_3$ melted at 205-220°C, 160-170°C and 210-220°C, respectively.

Kolesnikov, Koton and Shostakovsky have all studied the polymerisation of methacrylates of the type $CH_2=C(Me)COOR_n$ in which M = Hg, Sn or Ge, and R = alkyl or phenyl. Poly (triethylgermano methacrylate) softened at about 180°C and was insoluble in many media which dissolve conventional methacrylate polymers but, in general, these products which are amorphous and whose stability is in the order Sn> Pb>Hg have revealed no outstanding properties.

Greater promise, at least for high temperature elastomers, attaches to the poly (phenylene ethers) which can be made either by the oxidation of phenols or via the diazo-oxides, while a newer departure in the fluoro-polymer field was noted in reference to a poly(perfluoroalkylene triazine) compound which has been made by the condensation of appropriate amidines.

Modified natural and synthetic polymers. The alteration of polymer properties by chemical treatments, particularly those involving grafting of secondary chains on to a given 'trunk', continues to attract attention. Santo (Hungary) and Alexandru (Rumania) have thus insolubilised poly(vinyl alcohol) by the radiation-induced grafting of polymethacrylate chains and by cyanoethylation, while Rafikov (U.S.S.R.) has now extended earlier American work on the polyoxyethylation of polyamides to the case of pendant groups in acrylamide polymers.

Modifications to cellulose were described by several Russian and American workers. Rogovin and also Ermolenko have employed a wide variety of reactions to produce cellulose derivatives bearing alkylammonium, hydrazide, polyamide, phosphoryl and other side groups, while Ivanov described an oxidation effected through the conjoint use of nitrogen oxides and periodate; this yields a stable polycarboxylic product suggested as suitable for use as an ion-exchange material. Usmanov (U.S.S.R.) and Chaudhuri (U.S.A.) both claimed improvements in the physical properties of cellulose or viscose cords; by the grafting of polystyrene or polyacrylonitrile on to these, products were obtained with improved stabilities to photochemical or microbial attack, better rubber adhesion and increased wet strength and modulus.

Starch/polystyrene grafts were described by Ceresa (U.K.) as made by mechanico-chemical modification, and by Berlin (U.S.S.R.) through a curious 'cryolytic' reaction, in which active sites for chain initiation are generated by mechanical rupture occurring in the slow freezing of starch solutions. Lastly, Shen (U.S.A.) gave an account of progress in work aimed at preparing dextranpoly-(vinyl pyrrolidone) grafts which are hoped ultimately to combine in a single material the desirable blood plasma substitute characteristics of both compounds.

Miscellaneous. Other topics having a 'new look' were included in papers by Kargin (U.S.S.R.) on the initiation of polymerisation at defect structures produced during the intensive mechanical disintegration of metallic salts, by Piccardi (Italy) on a supposed controlling effect of low frequency electromagnetic fields on the polymerisation of acrylonitrile, by Simha (U.S.A.) on kinetic problems in the synthesis of polynucleotide analogues, and by Wolkober (Hungary) on the formation of polymeric azo dyes from the reaction products of arylamines with poly(vinyl chloride).

New Instrument Controls Oxygen in Dounreay Reactor Coolant

A RESISTIVITY meter, or 'rhometer,' which provides a continuous check on the amount of oxygen in sodium or sodium/potassium reactor coolants—as used in the Fast Breeder Reactor of the U.K. Atomic Energy Authority at Dounreay—has been developed by Dounreay engineers. It is very important to ensure that the amount of oxygen in the coolant is kept as low as possible, to avoid the formation and deposition of oxide in the cooling circuit.

The new device, which the A.E.A. is to exhibit at the 5th International Instruments and Measurements Exhibition in Stockholm, is based on the fact that impurities in a metal increase its resistivity. In the particular case of oxygen in liquid sodium/potassium (NaK) a 1 p.p.m. by weight increase of oxygen raises the resistivity of the NaK at 300°C by about 100 p.p.m. However, the temperature coefficient of resistivity of sodium is also high, only 0.04°C change being necessary to produce a 100 p.p.m. resistivity change, and one of the major features of the instrument is the way in which it compensates for temperature changes. To effect its measurements the rhometer operates on liquid metal drawn from the main circuit and passed through a toroidal pipe forming the secondary load of a transformer with a double loop magnetic core.

In the Dounreay reactor the instrument has also proved of great value in locating the origin of gas entrainment; it permits ready identification of gas bubbles by the large resistivity changes they produce. Oxide particles passing through the meter can be seen as pulses on the recorder chart, so the meter can also indicate whether oxygen content is above or below the saturation level and thus can determine saturation temperature.

Wide Range of Subjects for A.C.S. National Meeting

A survey of the growing Russian chemical industry, precise measurements of the fallout in crops, and the development of a new fireproof rubber are among subjects scheduled for discussion at the 138th national meeting of the American Chemical Society, which will be held in New York City, 11-16 September. Progress toward reducing air pollution, techniques for re-using nuclear wastes, and advances in such fields as science education, mental health, nutrition, building materials, petroleum, agriculture, plastics, and sanitation also will be discussed.

A potential new drug for leprosy—now ready for clinical testing, new central nervous system stimulants, and compounds of possible value in oral treatment of diabetes will be reported on the Medicinal Chemistry Division programme.

Chemist's Bookshelf

RECENT BIOCHEMICAL ADVANCES

PROGRESS IN BIOCHEMISTRY SINCE 1949. By *Felix Haurowitz*. Interscience, New York, 1959. Pp. xii+358.

This is primarily a book for the specialist working in his own small corner of the great field of biochemistry. It will enable him, as its compiling has enabled the author himself, to come abreast of the present state of biochemistry as a whole, since it will give him a fair and comprehensive picture of those aspects which do not lie within his own nook of research.

Professor Haurowitz, having toyed with the idea of inviting the collaboration of experts in the various branches of his study, and producing what would have amounted to a symposium volume, rejected the proposition in favour of a one-man book which would have a greater chance of appearing in print without interminable delay. In the event he has justified his choice.

This progress is slightly shorter than the previous one (English edition 1950), though it contains more matter. One characteristic is its high degree of compression, with a terse style and the more diversive topics presented parenthetically in smaller type. The references following each sub-chapter, relating in the main to original papers, have been prevented from stealing too great a proportion of space by severe abbreviation of the titles of scientific journals. In keeping with this tendency, a list of the abbreviations commonly used by biochemists to describe compounds of unwieldy chemical title appears in the front of the book. Notwithstanding the author's economy of space, the text is amply illustrated with graphic formulae and reaction sequences. Welcome emphasis is placed on the physics of biochemical energy transformations. Among the most interesting chapters for a general scientific reader is that dealing with biologically active substances elaborated by micro-organisms and higher plants, outlining the biosynthesis of vitamins, antibiotics and alkaloids.

There is a good index. The book is very readably printed and neatly bound. It can be recommended to any biochemistry student, graduate or undergraduate, who seeks to supplement and bring up to date the knowledge in his standard textbooks.

PETER COOPER

International Outlook on Carbohydrate Chemistry of Biological Interest

FOURTH INTERNATIONAL CONGRESS OF BIOCHEMISTRY. VOL. I. CARBOHYDRATE CHEMISTRY OF SUBSTANCES OF BIOLOGICAL INTEREST. Edited by *M. L. Wolfrom*. Pergamon Press, London, 1959. Pp. xii+206. 63s net.

The authors of the papers appearing in this symposium have been chosen not only on account of the outstanding contributions of their laboratories to our knowledge of carbohydrate chemistry, but also with a view to presenting an international scientific front. Of the 13 chapters forming the bulk of the book, three are in German and one in French, while the mother tongue of the speakers is retained in reports of discussions.

By contrast with contemporary symposia in general these discussions seem all too short, and one gets the unwanted impression of individual expertise isolated on a pedestal, rather remote from competent criticism. Perhaps this is inevitable when exploring highly specialised aspects; nonetheless it detracts from the full value of a symposium.

Three chapters, on hemicellulose, seaweed polysaccharides and plant gums, cover ground of economic importance. The micro-biologist, who will be concerned with creating the "small, well-selected library of antisera" which one author visualises as necessary equipment of the carbohydrate chemist, will read the fourth chapter with particular interest.

Discussion of the biological significance of amino-sugars involves neutral polysaccharides based on N-acetylamino-sugars, acidic compounds based on hexosamine, the sialic acid series and the rare sugars derived from antibiotics by hydrolysis. The labile sialic acids appear again later in connection with the gastric mucosa and cerebrospinal fluid; as ganglioside they are concerned with neurotoxic reactions to tetanus toxin, and they have a bearing on virus infections.

In nature, several paths may lead to the biosynthesis of monosaccharides, which are not well tolerated except in pathological conditions. Discussion of the nucleic acids which lie at the root of biological continuity, leads one to the glycosides, which constitute an important group of plant products with cardio-active properties. Plant metabolism is associated with non-reducing oligosaccharides. The paper on phenylhydrazones and related derivatives offers, by contrast, a glimpse of the analytical aspects of carbohydrates. A final recapitulation by the editor underlines the more significant contributions.

This is a specialist's book; to the carbohydrate chemist it will be invaluable.

PETER COOPER

Methods Available for the Measurement of Fine Particles

FINE PARTICLE MEASUREMENT. By *Clyde Orr* and *J. M. Dallavalle*. Macmillan, New York and London. Pp. 353. 73s 6d.

In many technological processes questions of particle size and surface area often outweigh almost every other consideration and their determination assumes first-rate importance. In these circumstances it is not surprising that practically every weapon in the scientific armoury has at one time or another been brought into play in solution of these problems and that a textbook which has any claim to their exhaustive treatment must range over the widest field.

Since the monograph under review claims not only comprehensive coverage but also that it is first in the field, these claims deserve close scrutiny. In the reviewer's opinion the authors succeed valiantly in their attempt to give the reader an overall picture of the potentially useful methods suggested through the years for evaluating fine powders and succeed moreover in evaluating in a critical fashion their relative merits. No less than 400 references, including important recent advances, are collected in an invaluable bibliography which every worker in the field will wish to have. On the other hand the detail provided for all but the simplest techniques is too sketchy to enable the laboratory worker to employ these techniques without lengthy recourse to the literature. This is no doubt due to lack of space. For the description of over 70 different techniques only some 270 pages, which include very many diagrams, have been made available. Also, it should be made quite clear that the authors deal only with techniques which have been developed primarily for relatively large particles or powders. For example, no mention at all is made of osmotic pressure methods for determining particle size in protein solutions nor of the viscosity techniques widely used in industry for characterising solutions of linear polymers or for investigating the degradation of fibrous polymers.

The experimental methods described are dealt with under the following headings: microscopy and sieving, sedimentation, inertial techniques, radiation scattering and transmission, permeametric techniques for surface area determination, gas adsorption methods, liquid phase adsorption and miscellaneous methods. The final chapter, which is one of the most useful, deals with the problems involved in pore size determination and distribution.

In some ways this is a disappointing book. On the other hand, for technologists in the many industries where particle size and surface area are important, it can hardly fail to be of interest, if only in demonstrating the very great variety of techniques now available in this field. But must a book of this small compass cost the poor technologist £3 13s 6d?

R. C. PINK

Chemist's Bookshelf

LECTURES ON POLYMER CHEMISTRY

PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON MACROMOLECULAR CHEMISTRY, PRAGUE. Pergamon Press, London, 1959. Pp. 306. 35s.

The title of this book may be a little misleading since the papers presented at the symposium, which was held in Prague in 1957, have been published in the *Journal of Polymer Science*. This volume contains the two main lectures of the symposium together with lectures given by international authorities at each session of the sections into which the symposium was divided. These latter include two Russian contributions given both in Russian and in English. Except in one case, lectures given by other than English or American lecturers are in French or German. Each lecture, except the first is followed by a discussion.

The two main lectures follow introductory speeches made at the opening of the symposium. The first lecture, by Professor P. M. Doty, on biological polymers, deals with configurations of polypeptides and also considers polynucleotides and nucleic acids. The work described is mainly that of the lecturer and his collaborators and few references to other work are given. Professor H. Mark surveys progress in the field of high polymers, dealing with fibres and fibre-forming polymers, new and improved plastics and elastomers. New developments are outlined and some newer polymers described, including stereospecific polymers, elastomers, copolymers and a linear high polymeric polyformaldehyde.

The other lectures are grouped under the headings of physics and physical chemistry of macromolecules and polyreactions. In the first of these groups Professor H. Benoit and Dr. G. Weill discuss some aspects of light scattering by polymer solutions including the study of polydispersity and the influence of anisotropy. Professor V. A. Kargin considers the structure and phase conditions of polymers and the nature of spherulites in some detail. Professor F. H. Muller contributes a lecture on the deformation of high polymers including elasticity, cold-drawing and the effects of deformation on dielectric properties. Professor A. Peterlin (in English) discusses non-Gaussian statistics of polymer chains in solutions, in relation to polymer-solvent interaction, polyelectrolytes, light scattering and streaming birefringence. Professor C. Sadron and Dr. R. Cerf consider some recent developments in streaming birefringence and derive theoretical expressions from models of polymer chains.

Thirteen lectures are grouped under polyreactions reflecting the interest in polymerisation. High conversion polymerisation of methyl methacrylate is discussed by Professor G. M. Burnett and Dr. L. D. Loan. Professor W. Kern considers some reactions of synthetic polymers including polythene, polyacrylics, polyvinyls and others. Professor M. Magat contributes a lecture on the initiation of polymerisation by gamma rays, considering the effects of variations in intensity and temperature, polymerisation of solid monomers and polymerisation in solution. Professor H. Morawetz discusses specific effects in polyelectrolyte solutions including complex ion formation, the specificity of ion binding and the use of polymers as catalysts for reactions of low molecular weight compounds. Professor S. S. Medvedev contributes a lecture on emulsion polymerisation in which mechanism, kinetics and energetics are discussed in detail. There is a long lecture by Professors Natta and Danusso and Dr. I. Pasquon on the mechanism and kinetics of α-olefin polymerisation in which stereospecific polymerisation is discussed. Professor D. C. Pepper gives a general survey of cationic polymerisation involving carbonium ions. Professor G. V. Schulz considers polymerisations in the study of the kinetics of radical reactions and Professor R. Simba discusses the mechanism and kinetics of chain degradation. Professor G. Smets considers the formation of grafts on polymer chains and Professor E. Thilo high molecular weight inorganic compounds particularly phosphates and silicates. Professor O. Wichterle contributes a survey of the present position in caprolactam polymerisation. The last lecture, dealing with organometallic compounds in polymer synthesis, is by Professor K. Zeigler and includes some suggested mechanisms of operation of Zeigler catalysts. The book ends with photographs showing aspects of the Symposium, both scientific and social.

Each lecture is generally well documented with references. Not the least interesting parts of the book are the discussions following lectures, although these are often in German. The lectures provide authoritative surveys of many branches of polymer chemistry and the book will be of great value to all chemists concerned with high polymers. For a book of this type the price is very reasonable.

W. R. MOORE

Survey of the Chemistry of Zirconium and its Compounds

THE CHEMICAL BEHAVIOUR OF ZIRCONIUM. By *W. B. Blumenthal*. D. van Nostrand. London, 1958. Pp. iv+398. 82s 6d.

The first item to catch the reader's eye in this book is the price, and all other features must be examined bearing that figure in mind. The author sets out to review comprehensively the published chemistry of zirconium (or, admitted, the chemistry of zirconium containing approximately 2% of hafnium). It is claimed that a critical survey of most aspects of the chemistry of the element and its compounds is given: this is largely true, but the reader must be prepared for breakdowns of the criticism when rather undigested cataloguing takes its place.

The approach to the task of presenting most of the information is reasonable, economical and, by modern standards, rational. Thus graphical and tabular summaries give much information in a small space and comparisons with other elements are similarly treated. Each chapter and section usually begins with a helpful physico-chemical introduction which enables the reader to keep track of the ensuing descriptive matter. Emphasis is placed on modern concepts of chemical bonding and solid-state chemistry, and by thoughtful classification some rules predicting uninvestigated properties are formulated. A worker in the fields of the "less familiar" elements, complex salts and interstitial compounds will find the book useful—particularly in view of the 1,800 references cited, each one given on the page of quotation. But the specialist will find that certain statements, while being nearly correct, need slight modification. Thus, "no action" might be changed to "slight action" with some improvement in accuracy. The text is readable but the reader must be prepared to differentiate between "affect" and "effect" for himself, and to sort out occasional sentences which, at first reading, leave him mentally gasping.

Returning to the price: is the book worth the money? Outside the U.S. the answer must be 'no'. In this respect the reviewer feels that the publishers deserve censure. Here is a specialists' book of distribution limited to a small number of libraries and to those workers (who have well-lined pockets) in relatively narrow fields: the publishers will find the cost of this type of book, admittedly well presented, will ultimately reduce the distribution in this country to zero.

World Production of Terephthalic Acid

The article on 'Recent advances in commercial terephthalic acid synthesis' (CHEMICAL AGE, 16 July, p. 106) placed U.S. production of terephthalic acid at an estimated 75 lb., due to rise to an estimated 125-150 million lb. by 1965. The former figure should, of course, read 75 million lb.

Russians' Compilation on Instability Constants of Complex Compounds

INSTABILITY CONSTANTS OF COMPLEX COMPOUNDS. By *K. B. Yatsimirskii* and *V. P. Vasil'ev*. Translated from the Russian by *D. A. Paterson*. Pergamon Press, London, 1960. Pp. viii + 218. £2 2s net.

It is necessary to compare this Russian publication with 'Stability Constants' Parts I and II by J. Bjerrum, G. Schwarzenbach and L. G. Sillén, the Chemical Society's Special Publications Nos. 6 and 7 (1957 and 58).

At the outset, it should be mentioned that some delay in producing a translation is unavoidable. Yatsimirskii and Vasil'ev review data up to 1954 (and, in some cases, 1955-56), the Special Publications were compiled from data available up to January 1956 (organic ligands) and mid 1957 (inorganic). The Chemical Society tables are more comprehensive; they cover 56 inorganic and 64 organic ligands, while the Russian tables cover 24 inorganic and 75 organic. The latter give the method by which the value considered by these authors to be most reliable was obtained, together with supplementary references, the former are more extensive but less critical. Thus for the five silver chloride complexes Yatsimirskii and Vasil'ev give four principal and seven supplementary sources; Bjerrum Schwarzenbach and Sillén give some 30 authors. The latter also give more extensive data on heat content and entropy changes. However, the greater comprehensiveness of the Chemical Society Publications is to be expected in view of their co-operative compilation under the auspices of the International Union of Pure and Applied Chemistry, and of their relative costliness.

The research worker with access to these works will nevertheless find the Russian book of value, and certainly it can be recommended for the research student and general laboratory. There is an introductory section dealing with methods of determining instability constants from experimental data, a thermodynamic description of complex formation reactions in solution, and a discussion of factors determining the stability of complexes in solution. All of which comprises nearly half the book, which is therefore much more than a collection of tables.

J. P. FARR

Fundamentals of Chemical Engineering Operations

In the review of the book 'Fundamentals of chemical engineering operations' by M. G. Larian (CHEMICAL AGE, 13 August, p. 245), it was stated that the price is 82s 6d, whereas it is in fact 62s 6d. In view of this the suggestion of the reviewer, in the last paragraph, that the only thing likely to dissuade the student from acquiring the book is the price, can obviously be modified.

Chemist's Bookshelf

NUCLEAR SCIENCE REVIEWS

ANNUAL REVIEWS OF NUCLEAR SCIENCE. Vol. 9. Edited by *E. Segre* and *L. I. Schiff* in association with *G. Friedlander* and *W. E. Meyerhof*. Annual Reviews Inc., New York. Pp. 625.

This volume presents a further series of 15 articles summarising aspects of the wide range of topics relevant to nuclear science. Two deal with specifically chemical topics: one on 'Technetium and astatine chemistry,' by E. Anders and the other on 'Solvent extraction in radiochemical separations,' by H. Freiser and G. H. Morrison. M. G. Ord and L. A. Stocken contribute a review of 'Biochemical effects of ionising radiations.' Many of the other articles have wide interest.

Technetium and astatine only occur naturally as short-lived decay products of the uranium and thorium series. They are both so rare and costly that little work has been done on them outside Government establishments and then usually only with trace quantities. The review, therefore, by going back to the scattered sources, helps to fill a prominent gap though it is recognised that there may well be a difference between behaviour on the trace scale of some investigations and on a macro scale. The pertechnetate ion is an effective corrosion inhibitor. Astatine, similar to iodine, is selectively concentrated in the thyroid tissue.

The article on solvent extraction systems classifies a lot of information in a very brief form. The systems are divided into two basic types according to whether they form chelate compounds or ion association systems. The chelates are then classified according to the reagent used and the pH at which different elements are completely extractable. The ion association systems are classified according to the solvent employed. A final section in this article reviews some of the apparatus suitable for laboratory extractions.

The authors of the review on biochemical effects record their regrets that information on precise radiation dosage history is so rarely given. Thus it was not possible for them to collate the published experimental results as they would have wished.

The long section devoted to nuclear fission summarises many interesting aspects of this asymmetric process and shows the limitations of current theory. Under 'Electronics associated with nuclear research' a brief survey is given of the application of semi-conductors in counting circuits; the use of photomultipliers; the problems of measuring short time intervals; and of large scale computing systems. Other papers deal with plasma research and fast reactors and have much of general and topical interest. The least convincing section in the volume deals with the vexed question of the economics of nuclear power. In this, no allowance can be made for the advantage of progress in so many supporting technological fields which is perhaps the greatest justification. Nor can it take into account the stimulating effects on other fuel industries.

In all, volume 9 contains much of interest but it is alarming to see that the size of this volume has markedly increased over that of its predecessors.

J. S. M. BOTTERILL

Theory and Practice of Analysis

METHODS IN GEOCHEMISTRY. Edited by *A. A. Smales* and *L. R. Wager*. Interscience Publishers Ltd., London. Pp. viii + 464. £4 14s net.

When chemical analysis ceased to be chemical the analyst was faced with a bewildering array of competing techniques; and when Fairbairn and his colleagues showed in 1951 that the classical methods were not quite as nice as they might be, analysts had very good reason to consider their ways and be wise. Now they can reorient themselves by buying Smales and Wager, as near indispensable a book as they make them, albeit costly.

By the fortunate propinquity of Harwell and Oxford the whole subject has been reviewed and presented with remarkable consistency. The classical methods are brought up to date by E. A. Vincent who also outlines the latest colorimetric methods and the rapid analysis of silicate rocks. From this base we enter the newer world of spectrochemical analysis (S. R. Taylor and L. H. Ahrens), fluorescent X-ray spectrography (H. I. Shalgorsky), stable isotope geochemistry and mass spectrometric analysis (K. I. Mayne), mass spectrometric isotope dilution analysis (R. K. Webster), radiochemical analysis (S. Moorbath), and radioactivation analysis (D. Mapper); in these chapters we have expert guidance on the theory and practice of each method and on their usefulness and limitations.

In the last chapter F. W. Cornish discusses some modern chemical separation methods, as preliminaries to analysis; and in the important second chapter L. R. Wager and G. M. Brown write on the collection and preparation of material for analysis, the moral of which is "don't analyse unless you are sure of what you are analysing".

Many people discover they are really geochemists; they will readily turn to *Methods of Geochemistry* where over 800 papers have been brought into perspective.

R. H. S. ROBERTSON

Chemist's Bookshelf

DATA ON ROCKET PROPELLANTS

ROCKET PROPELLANT HANDBOOK. By *B. Kit* and *D. S. Everest*. Macmillan Co., New York. Pp. 346. 87s 6d.

There is a large variety of chemical compounds which could qualify theoretically as rocket propellants. Many have been rejected in the past because their practical value has been restricted by physical features such as freezing and boiling temperatures, storage, density, toxicity, availability and cost. Much of the data for assessing these points has had to be gathered painstakingly by searching the literature. Hence a handbook with it all collected in one volume is a valuable contribution to rocket technology.

Almost a hundred compounds are included, ranging from the common oxidants like oxygen and nitric acid to the more exotic fuels such as dimethylberyllium and tetraethyl silicate. They are classified into inorganic and organic divisions and include liquid monopropellants and bipropellants, solids and gases. The latter are given a special section and this is primarily concerned with the use of gas for pressurising rocket feed systems.

Solid propellants, which have been widely adopted in rocket missiles, are given somewhat disappointing treatment. This may be because they are normally mixtures of a number of substances and exact formulations may be restricted by security. The individual compounds are included at various points in the book, but there is little guide to the performance to be expected from a practical propellant.

On the other hand, liquids are easy to assess and performance figures are given with most of them. While this is an important feature, it must be considered in conjunction with the physical properties and logistics. It is in these sections that the handbook will be of greatest value. There are tables giving the characteristic data and paragraphs on methods of storing and handling of each compound. Costs have, wisely not been quoted but efforts have been made to indicate the economic feasibility.

Altogether the authors have produced a usable handbook which should be welcomed by all who have any contact with rocket propellants, whether as performance experts, development engineers, or Service users. In addition it should have considerable value to the chemical industry, manufacturers of storage and handling equipment, and many others.

A. D. BAXTER

'Thousands of References' on Organic Halogen Compounds

METHODEN DER ORGANISCHEN CHEMIE (HOUBEN-WEYL). VOL. V, PART 4. HALOGEN COMPOUNDS (CONTINUED). Edited by *E. Müller*, 4th Edition, newly revised. Georg Thieme Verlag, Stuttgart, 1960. Pp. xlvii + 894. DM180 (subscription price DM162).

Reviews of earlier instalments of the well-known 'Houben-Weyl' have appeared in CHEMICAL AGE, 1959, **81**, 288, 861. The present part is the second of two (in Vol. V) devoted to organic halogen compounds, and deals with the formation of bromo-compounds and iodo-compounds, and the reactivity and transformation of chloro-, bromo- and iodo-compounds (the formation of chloro-compounds is covered in Part III).

The first section of this part deals with the preparation and properties of brominating agents commonly used in organic chemistry. Then follow examples of the uses of these in the formation of bromo-derivatives from olefines, by replacement reactions, and via special synthetic and cleavage reactions. A similar survey of iodination of organic compounds follows logically. Finally, a detailed account of the reactions and transformations of organic halogen compounds, including chloro-compounds, is given.

As in earlier volumes, the mass of information is presented in a systematic manner, tables being used extensively, making it easy for the reader to find details of, or a literature reference to, the particular procedure of interest to him. Thousands of references from hundreds of the world's chemical journals (up to and including 1958) are given, as in previous parts. Many useful drawings of special apparatus are included. In brief, this work is an encyclopaedia of the preparative organic chemistry of halogens. Fluoro-organic compounds are included but might perhaps have had a section to themselves, as they have become very important in recent years.

The usual list of journals consulted, author index and subject index are provided. The expected high standard of the work has been fully maintained. Errors appear to be few, and the excellent quality of binding, paper and print continues. The contributors and the editor continue to render a service to organic chemistry by compiling all this information; the whole work eliminates the necessity for a great deal of time-consuming literature searches.

A. R. PINDER

Plant Design for Chemical Engineers

CHEMICAL ENGINEERING PLANT DESIGN. By *F. C. Vilbrandt* and *C. E. Dryden*. McGraw-Hill, New York, 1959. Pp. ix + 534. 93s net.

This volume has been a part of the chemical engineering literature for 25 years, and the present edition is a much enlarged version. To the reviewer, however, this book has always posed some problems, despite its importance. In the first place much of the value of a work of this kind rests upon the relevance of the extensive data it contains. It is inevitable that this is reduced outside American practice, and indeed two previous editions appeared during the war and subsequent period when this was especially true. Of course one may say that the methodology of the text has some intrinsic worth to the student, quite apart from the practical value of the data.

In the present edition Chapters 1 to 4 deal with the basic principles of process development and design in a fashion that is very suitable for students (although rather too simple for professional engineers), while Chapter 5 makes a useful extension of the treatment. Chapter 6 is the really outstanding feature of the edition, and is very complete indeed in its coverage of the costs of unit operations and equipment. The section on the economic analysis of projects included in this chapter is also excellent. Chapter 7 on the location of chemical plants is of course limited to American geography, climate and legislation. Chapters 8 and 9 deal with the details of site preparation and process auxiliaries insofar as they affect the overall design. Chapter 10 is an important feature of the present edition, extending the treatment to the particular problems associated with the inclusion of nuclear power equipment in chemical works.

In conclusion then, despite the limitations imposed by translation from American practice, this book must be strongly recommended, to both students and engineers, for there is no equivalent available in Britain.

T. K. ROSS

Effluent and Water Treatment Convention in London

The first Effluent and Water Treatment Convention and Exhibition is to be held at Seymour Hall, London W.1, on 18-21 October. Among the subjects discussed will be the different methods of controlling and treating different trade wastes. Industries that will be represented by delegates include the oil and petroleum, synthetic detergents, sewage and water treatment, plastics and gas industries.

C.B.M.P.E. Annual Dinner

Principal guest and speaker at the annual dinner of the Council of British Manufacturers of Petroleum Equipment, to be held at Grosvenor House, London, on 5 October, will be Sir John G. Wrightson.

Overseas News

U.S. PROJECT FOR FISSIO-CHEMICAL PRODUCTION OF HYDRAZINE FROM AMMONIA

PROGRESS in using nuclear energy to transform a cheap and plentiful chemical into a powerful space age fuel, using 'fissio-chemistry' techniques, is reported by Aerojet-General Nucleonics, San Ramon, California, U.S. The company's extensive research on the fissio-chemical production of nitric acid led to a contract with the Air Force Manufacturing Technology Division of the Air Material Command's Aeronautical Systems Centre to investigate the possibility of producing the space age fuel hydrazine from liquid ammonia. Test equipment for the fissio-chemical production of hydrazine is now being completed and that it is planned for in-reactor operation "early this fall".

In the new process, anhydrous hydrazine will be directly produced, thus avoiding conventional separation steps. Other chemicals used in the conventional process, such as chlorine, will not be required.

If the experiment is a success, knowledge gained could lead to the development of a plant designed to produce hydrazine at a fraction of its present cost through the use of a nuclear reactor.

Hydrazine, a powerful but storable fuel, offers near instant reaction time to liquid propellant I.C.B.M. range missiles. As noted in CHEMICAL AGE, 27 August, p. 325, Olin Mathieson Chemical Corporation have recently received a $25 million contract for delivery of hydrazine for the U.S.A.F. Titan II intercontinental ballistic missile. Hydrazine has vast potential for space applications because of its density, storability and burning characteristics. It can also be used as a mono-propellant for vernier jets, gas generators and for other auxiliary power units.

Dow Chemical Will Participate in Spanish Petrochemical Venture

An agreement has been reached between Dow Chemical International Ltd. S.A., and Union Quimica del Norte de Espana S.A. (Unquinesa)—one of the foremost Spanish manufacturers of organic and inorganic chemicals and plastics, with headquarters in Bilbao—to construct a petrochemical complex in Spain. The basis of the agreement is Dow's financial and technical participation in the development of a petrochemical industry in Spain. An approval for the joint venture has been already secured from the Spanish government.

Under terms of the agreement, Dow will purchase a new issue of Unquinesa stock with a par value equal to the presently issued stock. Moreover, the Spanish company, which will probably change its name to Dow-Unquinesa S.A., will be entitled to technological know-how and engineering and marketing assistance from Dow.

The development plan calls for the construction of a cracking unit which will produce ethylene and propylene. The resulting C4 fraction will be further processed to recover butadiene. Off-gas will be used in Unquinesa's existing methanol plant, substituting for gasified carbon materials. These new basic raw materials will then be used by the Spanish company in the manufacture of a wide range of chemicals and plastic materials, such as polythene, polypropylene, polystyrene and others.

Japanese Maleic Plant to Use S.D. Process

A maleic anhydride plant using the Scientific Design process of fixed-bed, catalytic, air oxidation of benzene will be built by the Miike Gosei Chemical Industry Co. Ltd., Ohmuta City, Kyushu, Japan. Plant design capacity will be 8 million lb. of maleic anhydride per year. Scientific Design, in addition to complete process design, will help Miike Gosei in setting standards and specifications, with design of the plant and equipment, and will assist during project engineering, construction and operation.

Monsanto (U.S.) Maleic Expansion Project is Complete

Scientific Design Co. also announce that they have completed Monsanto Chemical Co.'s 20 million lb./year expansion project, using the S.D. maleic anhydride process. The new Monsanto unit is now on stream and operating satisfactorily. Monsanto's maleic capacity now totals 60 million lb./year and the company is the world's largest producer.

U.S.A.E.C. to Produce Their Own Fuel for Hanford Reactors

The Atomic Energy Commission have decided to produce themselves the fuel element billets for the New Production Reactor (NPR), now under construction at the A.E.C.'s Hanford, Washington, works. After consideration of proposals for the manufacture of the billets in privately owned facilities. The A.E.C. decided that the prices quoted were considerably higher than the cost of producing them in A.E.C. facilities. The A.E.C. costs were adjusted to include costs not normal to government operations but common to commercial enterprises. The A.E.C., through industrial contractors, operates large seed materials processing plants at Fernald, Ohio, and Weldon Spring, Missouri, where the billets will be produced.

The rejected proposals were received from Engelhard Industries Inc., National Lead Company (Nuclear Metals Division), Olin Mathieson Chemical Corporation, and Mallinckrodt Chemical Works (joint venture), and Westinghouse Electric Corporation (Atomic Fuel Department).

A contract to supply nuclear fuel for power plants at two far-flung Army posts—at Fort Greeley, Alaska, and Camp Century, Greenland—has been granted Olin Mathieson Chemical Corporation by the U.S. Atomic Energy Commission. Power plants at both sites are being built under the direction of the Army Corps of Engineers. The nuclear core components being made by Olin Mathieson at New Haven, Conn., will be replacement parts.

Italy Exports Higher Value, Lower Quantity, of Synthetic Rubber

In the first five months of the current year, Italy exported 12,213 tons of synthetic rubber to a total value of Lire 3,349 million. This constitutes a slight drop in quantity but a considerable increase in value in comparison with the figures recorded in January/May 1959 (12,379 tons for Lire 2,884 million).

Montecatini Will Make Dimethyl Terephthalate by German Process

Montecatini, of Italy, have been granted a licence by Chemische Werke Witten GmbH, of Witten (Ruhr), (who manufacture plastic fibres and basic materials for plastic products) for the production of dimethyl terephthalate by the patented Katschmann process. Dimethyl terephthalate is a basis for the manufacture of polyester fibres, known in Germany under the Trevira trade mark.

The German company will make its technical knowledge available to Montecatini in constructing a factory for the production of the product.

Similar licences have been granted to a French and a U.S. firm, while Chemische Werke Witten's technical know-how has also been used in the building of a plastic fibres plant in the U.S.S.R.

Houdry Process Corp. Licenses Thailand's First Catalytic Unit

The first catalytic petroleum installation of any kind in Thailand has been licensed by Houdry Process Corporation of Philadelphia, U.S., to the Defence Energy Department of the Government of Thailand. The new catalytic cracking unit, which will operate at high conversion levels, will provide raw materials for manufacturing aviation gasoline and

high quality motor fuel. It will be built on the Chao Phraya River outside Bangkok, Thailand. Completion date is late 1961.

The new unit, which will have a licensed capacity of 2,000 bbl./day of fresh feed, is the first Houdry-licensed unit on the mainland of Asia.

Ultra High Temperature Study and Solar Energy Report Published

A four-year study of ultra high temperatures and a report on the possibility of storing solar energy, both the result of U.S. Air Force-sponsored research, have been released to science and industry through the Office of Technical Services, Business and Defense Services Administration, U.S. Department of Commerce. One is entitled 'Study of Ultra High Temperatures', by A. V. Grosse and C. S. Stokes, Research Institute of Temple University for Wright Air Development Center, U.S. Air Force, 26 pages (Order PB 161460 from OTS, U.S. Department of Commerce, Washington 25, D.C., $1). This is the final report covering study of various chemical and physical phenomena at temperatures up to 5,000°K.

The other report is 'The Hill Reaction as a Model for Chemical Conversion of Solar Energy', by R. J. Marcus, Stanford Research Institute for Air Force Office of Scientific Research, 6 pages. (Order PB 161462, 50 cents.) The possibility of storing solar energy for use during dark periods by decomposing water into its elements has been investigated two ways. The first method investigated the electron transfer spectra of inorganic ions. The second method concentrated on various Hill reaction oxidants. Two new electron acceptors were found to be active.

New Silician Plant Will Process Rock Salt

Societá per Azioni Mineraria Siciliana (SAMS) of Palermo is increasing its capital in order to finance the construction of a new plant for processing of rock salt at Porto Empedocle, in the Province of Agrigento, Sicily.

600 Scientists to attend IAEA Isotope Conference in Copenhagen

Preparations are now almost complete for the major scientific conference on the use of radioisotopes in the physical sciences and industry which will meet in Copenhagen from 6-17 September. Some 600 scientists from some 40 countries and several international organisations are expected to attend.

The conference is being held by the International Atomic Energy Agency (IAEA) in co-operation with the United Nations Educational, Scientific and Cultural Organisation (UNESCO).

PEOPLE in the news

● **Dr. S. D. Hamann,** who since 1952 has been in charge of the C.S.I.R.O. high-pressure laboratory in the chemical engineering department of the University of Sydney, has been appointed chief of the C.S.I.R.O. Division of Physical Chemistry at Fisherman's Bend, Victoria. He succeeds **Dr. K. L. Sutherland** who resigned to be director of Research for the Colonial Sugar Refining Co. Ltd. Another C.S.I.R.O. change is the retirement from active duty of **Mr. S. A. Clarke,** chief of the Division of Forest Products.

● **Mr. F. A. C. Guépin.** director of the Royal Dutch Shell group in Holland, has been awarded the Grand Cross of Merit of the German Federal Republic.

● **Mr. J. H. Fairweather,** 57, laboratory assistant in the Morgan Crucible Co. Ltd., Battersea research department, has been awarded £225 under the company's suggestion scheme. His alteration to the cooling system of a laboratory furnace will save approximately 10 million gallons of water a year, and represents an annual saving to the company of £400. Mr. Fairweather's success comes after 21 years with the company, which, already this year, has paid out £790 to employees under the scheme.

● **Lord Plowden, Sir Geoffrey Crowther** and **Mr. H. F. R. Catherwood** have been re-elected directors of the British Aluminium Co. **Mr. G. A. Anderson, Mr. E. F. O. Gascoigne** and **Mr. J. Ritchie** retired by rotation and were also re-elected, while **Mr. L. B. Robinson** and **Mr. R. G. H. Linzee** retired from the board.

● **Dr. R. H. Griffith,** director of research at the Gas Council's London Research Station, has retired from his post. He is well known as an authority on catalysis. In 1945 he was appointed senior research chemist to the Gas Light and Coke Co., a position he continued to hold with the North Thames Gas Board after nationalisation. On the retirement of Dr. Hollings in 1952, Dr. Griffith was appointed controller of research of the Board and director of the London Research Station of the Gas Council. He is a Fellow of the Chemical Society and of the Institute of Fuel, a member of the Faraday Society, and has been a member of council of the Institution of Gas Engineers. The Gas Council are to review the research activities of the Council shortly, and for the time being **Mr. Hopton,** senior research chemist, will be responsible for research at the Fulham laboratories of the London Research Station.

● **Prof. R. C. Elderfield,** professor of chemistry in the University of Michigan, U.S., has been appointed chairman of the Division of Chemistry and Chemical Technology of the U.S. National Academy of Sciences—National Research Council.

● **Mr. G. F. Whitby,** managing director of I.C.I. Fibres Division, has been appointed chairman of the division. **Dr. E. B. Abbot** has been appointed managing director.

● **Mr. G. J. Williamson,** head of the chemical engineering section at the Billingham Works of Imperial Chemical Industries (engineering developments department), has been elected chairman of the North-Eastern Group of the Institution of Chemical Engineers.

● The Pyrethrum Board of Kenya has announced the appointment of **Mr. A. Bakker** as its sales representative in Belgium, Denmark and Holland. He will be directly responsible to the Board but will operate from Brussels. **Mr. R. H. McLellan** will remain the European technical sales representative of African Pyrethrum Technical Information Centre Ltd.

● **Prof. R. E. Lane, C.B.E.,** and **Mr. T. A. Oxley, B.Sc., A.R.C.S.,** have been appointed by the Minister of Agriculture, Fisheries and Food, together with the Minister for Science, the Secretary of State for Scotland and the Minister of Health, to succeed **Dr. Hunter** and **Dr. Galley** on the research study group on toxic chemicals used in agriculture and food storage. Prof. Lane is Nuffield professor of occupational health at Manchester University and Mr. Oxley is an assistant director (advisory) of the Tropical Products Institute. Dr. Hunter has resigned his position on the study group owing to pressure of his medical duties; Dr. Galley has resigned on joining an industrial firm which has an interest in agricultural chemicals.

N.E.L. Course on Flow of Liquids

First course in a series designed to allow technologists to familiarise themselves with research trends will be held by the D.S.I.R. National Engineering Laboratory, East Kilbride, early in 1961. It will deal with the flow of liquids, chemical processing, hydro installations, etc.

Commercial News

- **Monsanto Maintain Interim At 5%**
- **Albright Show Increased Group Profit**
- **Powell Duffryn Carbon Products Outlook**
- **Witco Take Over Oil Processing Plant**

Albright and Wilson Ltd.

The board of Albright and Wilson Ltd. have declared an interim dividend on the ordinary stock of 6%, less income tax, in respect of 1960. This is at the same rate as the interim for 1959 but is payable on the share capital as increased by the issue in September, 1959 of one-for-four fully paid shares and by the shares issued in exchange for the shares of A. Boake Roberts and Co. (Holding) Ltd.

The unaudited results of the group for the six months ended 30 June 1960, which include figures in respect of six months to 30 June for Boake Roberts, which became part of the group during that time, show a group net profit of £1,238,000 after deduction of profit attributable to outside shareholders of subsidiary companies (1959 figure: £1,127,000) and a profit attributable to A. and W. shareholders of £1,195,000 (1959: £1,060,000).

Profits for the first half of 1960 have been affected by increased competition, particularly in Canada and Australia. The Canadian results have also been influenced by the recession in the uranium industry. The full effect of these factors will be felt in the second half of the year but profits for 1960 as a whole, as indicated earlier this year, are not expected to differ significantly from the comparable figures for 1959.

Continental Oil Co.

A net profit of $28.49 million or $1.35 per share, is reported for the first half 1960 by Continental Oil Co., U.S. This compares with $29.16 million ($1.38 per share) for the corresponding 1959 period. Sales rose over the period from $380.64 million to $390.71 million.

Dow Chemical

Record sales of $781,433,740 and net earnings after taxes of $82,404,342, or $3.01 per share for the fiscal year ended 31 May, are reported by Dow Chemical Co., U.S. The sales increase was 11% over the preceding year, the net up 31% and earnings per share up 26% on the 27,362,631 shares outstanding. Shares outstanding increased by 4% from the 1959 total.

Sales revenue was derived approximately 51% from chemicals, 36% from plastics, 7% from magnesium and 6% from agricultural chemicals. Out of each sales dollar 41.2 cents went for raw materials and supplies, 27.4 cents for manpower costs, 9.9 cents for depreciation, 11.1 cents for taxes, 4.6 cents for cash dividends and 5.8 cents reinvested in the business.

The board have declared a 2% stock dividend—one share for each 50 held—in addition to a quarterly cash dividend of 35 cents per share on its common stock. Both dividends are payable to stockholders of record at the close of business on 16 September 1960. The cash dividend is payable on 15 October 1960, and the stock dividend on 1 November 1960.

W. and H. M. Goulding

In 'Project News' (p. 195) in our issue of 6 August, it was stated that W. and H. M. Goulding Ltd., Dublin, had earlier in the year disposed of their 51% holding in Richardson's Chemical Manure Co. Ltd. and Ulster Manure Co. Ltd., to I.C.I. This was an error: it should have been stated that W. and H. M. Goulding Ltd. had disposed of 51% of its holding in the two companies mentioned. W. and H. M. Goulding therefore retained 49% in both these companies, which is, of course, a very different situation from that implied in the erroneous statement.

Monsanto Chemicals Ltd.

Half-year statement from Monsanto Chemicals Ltd. reveals that sales amount to £10,374,000, an increase of 19% over the first six months of 1959. Gross profits are £1,320,000—an 83% increase and taxed earnings, at £651,000, 75% higher. Bringing into full production of the Fawley polythene plant has had a significant effect on improved profit margins.

In spite of the increased sales and profits, the interim dividend is being maintained at 5%.

Powell Duffryn

Considerable improvement in turnover and profit on the manufacture of heat exchangers and other chemical equipment in graphite was reported by the chairman of Powell Duffryn Ltd. in his annual statement. During the year, Powell Duffryn Carbon Products reached the stage at which full production on the machining and treatment of graphite for atomic power stations was possible; unfortunately, output was lower than planned due to continual changes in reactor design outside the company's control. "It would seem that we can look forward to the profitable employment of this plant for at least the next two years, but, at the moment, I would not care to look further ahead in this new field of energy production which is so subject to changes whether of a scientific, industrial or political character."

Witco Chemical

Witco Chemical Co. Inc., have purchased the U.S. oil processing company of Sonneborn Chemical and Refining by the issue of 300,000 shares, valued at about $12 million.

INCREASES OF CAPITAL

GRAESSAR SOLICYLATES LTD., manufacturing chemists, etc., Sandycrofts, nr. Chester. Increased by £40,000 beyond the registered capital of £75,000.

B. FINCH AND CO. LTD., Belvedere Works, Shenwood Road, Barkingside, Essex. Increased by £120,000, beyond the registered capital of £220,000.

PHILIP HARRIS LTD., 144-8 Edmund Street, Birmingham. Increased by £120,000, in £1 ordinary shares, beyond the registered capital of £200,000.

NEW COMPANIES

D. O. EVANS LTD. Cap. £3,000. Consulting, analytical, manufacturing, pharmaceutical and general chemists, etc. Directors. O. Evans and Edith M. Evans. Reg. office: 406 Bank Chambers, 329 High Holborn, London W.C.1.

GERMOTOL LABORATORIES LTD. Cap. £1,000. Importers, exporters, buyers and sellers of and dealers in merchandise of all kinds, including chemicals, chemical equipment, etc. Directors: K. W. Hole, A. H. Riseley. Reg. office: Willow Road, Poyle Estate, Colnbrook, Bucks.

BASF CHEMICALS LTD. Cap. £50,000. Manufacturers of and dealers in chemicals, dyes, plastics, recording tapes, fertilisers, varnishes, solvents, etc. Subscribers: R. J. Freeman, and S. M. Cretney. Solicitors: Neish, Howell and Haldane, E.C.4. Reg. office: 30 Southampton Buildings, Chancery Lane, London W.C.2.

GOVANHAUGH WORKS LTD. Cap. £100. To manufacture lead, zinc, glass, oil, colour and metal and deal in solder, metal rollers, chemical plumbing and builders' sundries, etc. Directors: S. G. Gandy, W. E. Grey and E. S. Gandy. Solicitors: James Turner and Son, 108a Cannon Street, E.C.4.

TRELCO LABORATORIES LTD. Cap. £100. Manufacturers of and dealers in chemicals, animal feeding stuffs, etc. Directors: F. Tyrrell and F. Higson. Reg. office: Trelco Works, Dawes Street, Bolton.

F. C. PLASTICS LTD. Cap. £22,000. Registered in Eire to manufacture waterproof fabrics, rubber, oil, synthetic and chemical-proof materials, etc. U.K. address: 140/142 St. John Street, London E.C.1.

H. OAKLEY LTD. Cap. £1,000. To carry on the business of consulting, analytical manufacturing pharmaceutical and general chemists, etc. Directors: Horace Oakley, Harry R. Oakley and Gladys M. Oakley. Reg. office: 406 Bank Chambers, 329 High Holborn, London, W.C.1.

TRADE NOTES

Dyestuffs for Polyester Fibres

A new range of dyestuffs, claimed to represent a marked new advance in the dyeing of polyester fibres, is being introduced to the U.K. by Alliance Dye and Chemical Co. Ltd., Bolton, sole agents for the Compagnie Francaise des Matieres Colorantes, Paris, who developed these dyestuffs.

The new range is being marketed under the name Esterophile and consists of "entirely new dispersed pigments which are characterised by outstanding fastness to heat treatments, together with light and wet fastness properties at least equal to those of conventional disperse dyes." The Esterophile dyes, applied by methods which are essentially the same as those employed for ordinary disperse dyes, are stated to be of particular value also, for application by the so-called Thermosol methods to both 100% polyester fibres and to blends with other fibres.

Chemical Centrifuges

Goodenough suspended pitless-type electrically-driven centrifuges for drying, clarifying, filtering and separating are described in a new brochure from Power Installations Ltd., Tudor Works, Bradgate Street, Leicester.

Corrosion Inhibitor for Anti-freeze

The use of sodium benzoate, together with sodium nitrite, as a corrosion inhibitor system in anti-freeze for vehicle cooling systems has become widespread in the U.K. in recent years. W. J. Bush and Co. Ltd., Ash Grove, London E.8, produce a ready-prepared sodium benzoate/sodium nitrite mixture, called Sobenite, which is claimed to be suitable for use in all types of vehicles. A 14-page booklet issued by the company describes Sobenite and its properties, and includes instructions for the preparation of two different formulations. The use of Sobenite as an inhibitor in plain water coolant is also discussed, and analytical methods for the determination of benzoate and nitrite are given.

Plastics Laboratory Taps

In a reference, on page 113 of our 16 July issue, to the new range of taps, cocks and fittings introduced by Tough Plastics Ltd., Addlestone, Surrey, it was stated that these were welded in nylon, polythene and polypropylene. The word 'moulded,' not 'welded,' should, of course, have been used.

Water Treatment and Descaling

An arrangement whereby the servicing and supplying of their marine water treatment customers will in future be handled by the Atlas Preservative Co. Ltd., Erith, Kent, has been announced by Albright and Wilson (Mfg.) Ltd. This covers the Hall system of boiler water conditioning which has been operated in the U.K. for many years past by Albright and Wilson (Mfg.) Ltd. who will continue to control its operation. The arrangement will also cover the application of Hagevap LP and the recently introduced H-400 scale solvent for descaling evaporators and all types of heating equipment.

Berk Bromo-compounds

Information sheets of a new type are being issued by F. W. Berk and Co. Ltd., 8 Baker Street, Portman Square, London W.1, and will in time cover the products, including bromo-compounds, dealt with by the company's organic and fine chemicals department. Sheets which have come to hand so far give data on cyclic bromides, alkyl bromides, the higher alkyl chlorides, HCl solutions, quaternary pyridinium halides, and on various other compounds (intermediates). Applications are described in each case.

New Telephone Number

The telephone number of Packaging Intelligence Ltd., Balfour House, Finsbury Pavement, London E.C.2, has been changed to Monarch 5258-9.

Impressive New Building for Union Carbide Ltd.

Union Carbide Limited moved their head office to 8 Grafton Street, London W.1, on 27 August. The headquarters of the chemicals, alloys, polythene and Kemet divisions will also be in this building, which is known as Union Carbide House. This is on the former site of the celebrated Grafton Galleries, bombed during the war. The facade has been rebuilt to blend in with adjoining buildings and the inside redesigned and rebuilt. A large nine-storey building with curtain-wall elevation has been erected in Bruton Lane, at a lower level, with a bridge connecting the upper floors to 8 Grafton Street.

Part of the large Union Carbide international organisation, Union Carbide Ltd. was formed in 1954 and now operates alloys plants at Sheffield and Glossop, a polythene plant at Grangemouth, a Kemet plant (manufacturing electronic components) at Aycliffe while the chemicals plant at Hythe, Hampshire, came on stream early this year.

Potassium Carbonate and E.F.T.A. Origin of Goods

Neutral potassium carbonate, anhydrous, has been added to the goods listed in the third schedule of the European Free Trade Association (Origin of Goods) Regulations 1960. For the purpose of determining the origin of goods produced from this product in the E.F.T.A. area, the material itself will be regarded as of area origin even if imported from outside the area. The change came into force on 17 August.

P.T.F.E. Electrical Sleeving

Details and samples of the company's ranges of p.t.f.e. thin wall, electrical sleeving may be obtained from Polypenco Ltd., 70 Tewin Road, Welwyn Garden City, Herts. The materials are produced from high grades of virgin Fluon or Teflon, permitting use in miniature assemblies. Among the properties claimed are, chemically inert, and fungus and sunlight resistant; unaffected by heat or moisture; non-inflammable, etc.

Change of Address

Union Oxide and Chemical Co. Ltd. have moved their offices to 6 Eldon Street, London E.C.2. (Telephone: Bishopsgate 6741.)

Market Reports

PRICES AND HOME DEMAND MAINTAIN LEVEL

LONDON Home trade demand for industrial chemicals has been well maintained with contract delivery specifications covering good quantities. There has also been a steady flow of enquiry for export. Prices generally are held at recent levels but a further reduction in the price of zinc oxide has been notified, the white seal being currently quoted at £105, the green seal at £103 and the red seal at £100 per ton.

There has been nothing of fresh interest to report in the market for agricultural chemicals, while an active movement continues in the coal tar products market with cresylic acid, crude carbolic acid and the xylols in good request.

MANCHESTER Chemical traders on the Manchester market during the past week have handled a fair number of fresh enquiries and, on the whole, replacement business is coming forward satisfactorily. There has again been little change in the price position, the undertone in most sections being steady. Home users are absorbing reasonably good tonnages of the bread-and-butter lines, including caustic soda, soda ash and other soda products, as well as the potash and ammonia compounds. One or two sections of the fertiliser market are busy and manufacturers of the compounds and of basic slag are now carrying satisfactory order-books.

SCOTLAND The past week has provided little alteration in the general trading position on the Scottish heavy chemical market. On reflection, buying was steady and fairly well distributed between spot and contract requirements covering the usual range of basic chemicals. The position of agricultural chemicals is unchanged, with the tendency still to seasonal quietness, although some activity can be reported in regard to weedkillers. Prices have mostly remained firm.

NEW PATENTS

By permission of the Controller, HM Stationery Office, the following extracts are reproduced from the 'Official Journal (Patents)', which is available from the Patent Office (Sales Branch), 25 Southampton Buildings, Chancery Lane, London W.C.2, price 3s 6d including postage; annual subscription £8 2s.

Specifications filed in connection with the acceptances in the following list will be open to public inspection on the dates shown. Opposition to the grant of a patent on any of the applications listed may be lodged by filing patents form 12 at any time within the prescribed period.

ACCEPTANCES

Open to public inspection 28 September

Process for the production of elastomeric plastics. Farbenfabriken Bayer AG. **849 759**

Extraction by the double solvent method. S.A.R.O.M. Soc. Azionaria Raffinazione olii Minerali. **849 760**

Method for the preparation of moulding materials from polyamides. Onderzoekingsinstituut. Research N.V. **849 788**

Polymerisation of ethylene. Hercules Powder Co. **849 855**

Manufacture of viscose. Vereinigte Glanzstoff-Fabriken AG. **849 417**

Process for the catalytic hydrogenation of reducible sugar. Udic Soc. Anon., Lausanne. **850 133**

Vinyl ester polymers. Revertex Ltd. **849 861**

Method for analysing gaseous or liquid mixtures. Hummel, H. **850 044**

1, 2-Chromium-containing benzene-monoazo-pyrazolone dyestuff complexes. Farbenfabriken Bayer AG. **849 705**

Process for preparing uranium tetrafluoride. Mitsubishi Kinzoku Kogyo Kabushiki Kaisha. **849 512**

Polymerisation process. Monsanto Chemicals Ltd. **849 956**

Pharmaceutical compositions useful in the treatment of hypertension. May & Baker Ltd. [Divided out of 849 282.] **849 357**

Polymerisation. Goodrich Co., B. F. **849 708**

Process for the manufacture of polyene carboxylic acids and meters thereof and polyene carboxylic acids and esters thereof. Hoffmann-La Roche & Co., F. **850 137**

Production of polymers and copolymers of acrylonitrile. Deutsche Akademie de Wissenschaften zu Berlin. **849 864**

Blend of microcrystalline wax and olefin polymer and method for production thereof. Phillips Petroleum Co. **849 389**

Catalytic polymerisation of olefines and catalysts therefor. Petrochemicals Ltd. **849 789**

Method and apparatus for replenishing hydrogen gas in a hydrogen gas electric-discharge device. Edgerton, Germeshausen & Grier Inc. **849 868**

Production and use of di-alcohols. Rhone-Poulenc. **849 514**

Salts of 2, 6-di-*tert*-butyl naphthalene-disulphonic acids. Ravensburg GmbH. **850 142**

Polyurethanes and coating compositions containing them. Du Pont de Nemours & Co., E. I. **849 791**

Preparation of bisphenols. Union Carbide Corp. **849 965**

Process for interacting organic compounds containing terminal methylene groups. Du Pont de Nemours & Co., E. I. **849 393**

Modified acrolin resins. Chemische Werke Albert. **849 401**

Substituted benzimidazoles. Farbenfabriken Bayer AG. **849 793**

Mixtures of urea derivatives and phenyl carbamic acid esters suitable as herbicidal compositions. Badische Anilin- & Soda-Fabrik AG. **849 794**

Process for sweetening sour hydrocarbon distillates. Universal Oil Products Co. **849 998**

Polyurethane resins. Petrochemicals Ltd. **849 405**

Light stabilised polymer compositions. Dow Chemical Co. **849 874**

Process for the alkylation of aromatic hydrocarbons. Universal Oil Products Co. **849 875**

Polymerisation of olefines. Petrochemicals Ltd. **850 002**

Water-soluble sulphonium dyestuffs. Farbenfabriken Bayer AG. **850 159**

Polymerisation of pyrrolidones and piperidones employing halides of Group IV elements as chain initiators. General Aniline & Film Corp. **850 160**

Electrolytic production of magnesium metal. Dow Chemical Co. **849 969**

Pyrazolonyl carbinols. Boehringer & Soehne GmbH., C. F. **849 879**

Carbamic acid esters and their preparation. Sterling Drug Inc. **850 003**

Derivatives of nitrofuran. Norwich Pharmacal Co. **850 006**

Salts of bis-dithiocarbamic acids. Chemische Werke Albert. **849 410**

Organo-siloxane gels. Midland Silicones Ltd. **849 885**

Polymerisation of butadiene. Montecatini. **849 589**

Polymeric materials. Du Pont de Nemours & Co., E. I. [Addition to 807 198.] **849 590**

Open to public inspection 5 October

Detergent compositions. Masci, J. N., and Poirer, N. A. **850 514, 850 515**

Manufacture of combustible gas. Humphreys & Glasgow Ltd. **850 362**

Akenyl aromatic polymers. Imperial Chemical Industries Ltd. **850 363**

Composition of the modified-tar type. Semtex Ltd. **850 364**

Preparation of elastomers. Dunlop Rubber Co. Ltd. **850 523**

Domestic detergents. Young, C. D. **530 366**

Fluorine-containing organosilicon compounds. Minnesota Mining & Manufacturing Co. **850 228**

Liquid detergent compositions. Unilever Ltd. **850 274**

Hydroxy-halogen-pregnenes and process for their manufacture. Ciba Ltd. **850 368**

Bonding of cured conjugated diene-vinylpyridine compositions. Phillips Petroleum Co. **850 370**

Crystalline polymers of alpha-olefins and the preparation thereof. Montecatini. **850 585**

Process for purifying mono carboxylic acids. Farbwerke Hoechst Aktiengesellschaft Vorm. Meister Lucius & Brüning. **850 373**

Tar products. Coal Tar Research Association. **850 796**

Process for the production of light-sensitive high polymer compounds. Farbenfabriken Bayer AG. **850 277**

Alpha titanium alloys. Mallory-Sharon Metals Corporation. **850 278**

Electrolytic production of perchlorates. Pennsylvania Salt Manufacturing Co. **850 378**

Lead dioxide-coated electrodes. Pennsalt Chemicals Corporation. **850 379 850 380**

Steroid compounds. Merck & Co. Inc. **850 734**

Polymers having mordant properties and photographic materials containing them. Kodak Ltd. **850 281**

Method of recovering heat in a chemical process. Simonek, J., Michalicka, L., Drasky, J., and Zoha, J. **850 282**

Aralkyl esters of unsaturated monocarboxylic acids and polymeric compositions obtained therefrom. Pittsburgh Plate Glass Co. **850 311**

Oxidation of aromatic hydrocarbons. American Cyanamid Co. **850 817**

Process for the manufacture of 2, 4, 5-trichloro phenol. Leuna-Werke Walter Ulbricht Veb. **850 382**

Production of pure silicon. Lonza Electric & Chemical Works Ltd. **850 819**

Oxidation of naphthalene to phthalic anhydride. American Cyanamid Co. **850 594**

Cyclopentanophenanthrene derivatives and processes for the production thereof. Syntex S.A. **850 386**

Control system and apparatus for catalytic processes. Phillips Petroleum Co. **850 597**

Process for upgrading catalytically reformed naphthes. California Research Corporation. [Addition to 772 823.] **850 600**

Manufacture of solid, stable diazonium compounds. Farbwerke Hoechst Aktiengesellschaft Vorm Meister Lucius & Brüning. **850 317**

Resinous articles having improved surface properties and method for their preparation. Montecatini. **850 471**

Process for the preparation of resins. Esso Research & Engineering Co. **850 472**

Process for the production of alkali metal and alkaline earth metal borohydrides. Studiengesellschaft Kohle. **850 606**

Process for the production of polyethylene compositions. Essener Steinkohlenbergwerke AG. **850 473**

Vitamin A aldehyde derivatives, and processes for their preparation. Takeda Pharmaceutical Industries Ltd. **850 475**

Method and apparatus for preparing polymers. Esso Research & Engineering Co. [Addition to 787 047.] **850 825**

Process and apparatus for producing carbon black. Huber Corporation, J. M. **850 323**

Gas chromatography apparatus and method of separating gas mixtures. Standard Oil Co. **850 608**

Acylated amino-acids and amino-sugars. Takeda Pharmaceutical Industries Ltd. **850 479**

Production of lithium sulphate. Canada, Department of Mines of. **850 480**

Acid addition salts of esters of piperidyl phenyl methanol and processes for their production. Rhone-Poulenc. **850 826**

Production of a new antibiotic flavenomycin. Montecatini. **850 325**

α, α[Cp-chlorophenyl-(4-pyridyl)] carbinols and method of preparing same. Maggioni & C.S.p.A. **850 298**

Reaction products of dextran-modified polyesters with urea-formaldehyde alcohol condensates and method of producing. Commonwealth Engineering Co. of Ohio. **850 534**

Production of gas mixtures of a desired composition. Imperial Chemical Industries Ltd. **850 535**

Substituted piperazines and processes for their production. Parke, Davis & Co. **850 661, 850 662**

Pyrimidine derivatives. May & Baker Ltd. **850 483**

Vinyl compounds and their manufacture. Badische Anilin- & Soda-Fabrik AG. **850 828**

Oxidation of organic compounds. Imperial Chemical Industries Ltd. **850 536**

Process for the preparation of acetanilide derivatives. Boots Pure Drug Co. Ltd. **850 394**

Manufacture of cellular polymeric materials. Imperial Chemical Industries Ltd. **850 664**

Steroids and the manufacture thereof. Upjohn Co. **850 833**

Production of alkylpyridines and alkylquinoline. Midland Tar Distillers Ltd. **850 405**

Purification of tungsten carbide. General Electric Co. **850 407**

Processes for preparing gas mixtures containing hydrogen and carbon monoxide. Bataafsche Petroleum Maatschappij N.V. De. **850 409**

Aqueous compositions having diminished corrosive properties. Imperial Chemical Industries Ltd. **850 746**

Vinyl halide polymer compositions. Rohm & Haas Co. **850 487**

Phthalocyanine pigments. Imperial Chemical Industries Ltd. **850 237**

Furfuryl alcohol resins. Hecker, F. [trading as Spies, Hecker & Co.] **850 413**

Process for the preparation of 1-(*p*-nitrophenyl)-4-carboalkoxy-4-phenyl-piperidines. Merck & Co. Inc. **850 417**

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